Scorpio
6001/2 MK & SK

USER'S MANUAL

0311375 Rev C

Issue : June 1999

FCC statement (USA)

The United States Federal Communications Commission (in 47 CFR 15.105) has specified that the following notice be brought to the attention of users of this product:

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference

will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interferences by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and the receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

The user may find the following booklet, prepared by the Federal Communications Commission, helpful: How to identify and Resolve Radio/TV Interference Problems. This booklet is available from the U.S. Government Printing Office, Washington, DC. 20402 , Stock No. 004-000-00345-4. Use of a shielded cable is required to comply within Class B limits of Part 15 of FCC Rules. Pursuant to Part 15.21 of the FCC Rules, any changes or modifications to this equipment not expressly approved by DSNP may cause harmful interference and void the FCC authorization to operate this equipment.

DSNP makes no warranty of any kind with regard to this equipment, including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose. DSNP shall not be liable for errors contained herein or for incidental consequential damages in connection with the furnishing, performance, or use of this equipment

This manual contains proprietary information which is protected by copyright. All rights are reserved. No part of this document may be photocopied, reproduced or translated into another language without the prior written consent of DSNP.

The information contained in this manual is subject to change without notice.

How to use this Manual

- Section 1 covers equipment unpacking and description for both base station and rover unit.
- Section 2 tells you how to prepare a project using the *KISS* software.
- Section 3 provides all the instructions required to install and run a base station.
- Section 4 contains all the information required to prepare the rover unit and use it in the field. This section is the reference documentation for the field operator.
- Section 5 tells you how to download the data contained in the PCMCIA after your field operations, using the *KISS* software.
- *Appendix A* is a short introduction to the GNSS system.
- *Appendix B* reviews all the products of the *Scorpio 6000* series.
- *Appendix C* presents the theory of operation of the LRK and KART processing methods.
- *Appendix D* is the reference documentation for the *Station Control Software*, a palmtop-run, user-interface program used at the base station.

- *Appendix E* describes the notation rules used in the SBIN and SVAR formats.
- *Appendix F* describes the GPS raw data available in the SBIN format.
- *Appendix G* describes the results files(SVAR format).
- *Appendix H* collects useful information for the troubleshooting of the system. Software installation is also described.

Table of Contents

1. Unpacking & Description 1-1

6001/2 MK Rover Unit 1-1
Unpacking..... 1-1

6001/2 SK Base Station 1-5
Unpacking..... 1-5

GNSS receiver description 1-8
Front Panel 1-8
Rear panel 1-10

PCMCIA Drive 1-11
Inserting a PCMCIA card 1-11
Removing a PCMCIA card..... 1-12

FSGS Palmtop Computer 1-13
FSGS Battery Pack..... 1-13
FSGS temperature ranges..... 1-14
Environment 1-14
Trickle-charged internal battery 1-14
Cleaning 1-14
Long-term storage 1-14
After long-term storage..... 1-15
Changing the NiCd battery 1-15

Preparing batteries for the Rover Unit..... 1-16

2. Preparing a project.....2-1

Introduction..... 2-1

Creating a project..... 2-1

Terminology used..... 2-7

Placing reference points on the map 2-8
Placing target points on the map 2-10
Preparing PCMCIA cards for field operators 2-13

3. Operating Instructions at the base station.....3-1

Station installation 3-1
Choosing a location where to install a base station 3-1
GPS antenna 3-1
UHF antenna 3-2
Connections and Setup 3-2
Measuring the GPS antenna height 3-4
DSNP measurement 3-4
USER measurement 3-5
Programming the base station (Quick Procedure) 3-7
Preamble 3-7
Getting the Palmtop software started 3-8
Programming steps 3-8

4. Operating Instructions on the Rover Unit 4-1

Preparing for a field survey 4-1
Assembling the various parts 4-1
Connections 4-3
Getting ready for surveying 4-4
Introduction to Palmtop Software 4-4
Palmtop Display 4-5
Keys and menus 4-5
Getting started 4-9
About *jobs* and *files* 4-11
Choosing a *job* 4-11
Choosing a *file* 4-14
Checking operating conditions before starting a survey 4-15
Surveying target points (Staking Out) 4-16

General case 4-16
Surveying target points through offset procedure 4-26
Logging points 4-34
General case 4-34
Logging points through offset procedure 4-36
Surveying a trajectory 4-43
Surveying reference points 4-46
Guidance along a profile 4-47
Refining the coordinate system by surveying reference points . 4-51
Refining the horizontal system (local grid) 4-52
Computing the vertical system (height correction) 4-56
Ancillary procedures 4-59
Working on the results of the job 4-59
Measuring the distance between any two points 4-61
Configuring the "next point" 4-63
"Search" function 4-64
Creating a point 4-64
Creating a line 4-66
Viewing points on a plane (2D view) 4-69
Recording Raw Data on PCMCIA 4-71
UHF receiver setting & base station identification 4-72
Viewing the solution of your current position 4-74
Viewing the status of the GPS constellation 4-75
Rejecting satellites 4-77
Processing & initialisation modes 4-78
Viewing the datum and projection used 4-81
Switching to WGS84 4-82
Using the notepad 4-83
Free memory space on PCMCIA and Palmtop, deleting geodesy description files 4-85
Tools box 4-87
Viewing the versions of the system's hardware parts 4-87
Editing Time & Date 4-87
Editing Geocodes 4-88

Editing uncertainties, acceptable deviation & battery alarm threshold 4-89
Measuring the surface of an area 4-90
Editing Units 4-94
Using the palmtop in standalone mode 4-94

5. Downloading field data.....5-1

Introduction 5-1
Collecting the results of a survey 5-1
Graphic Conventions 5-3
Before surveying 5-3
After surveying 5-3
Editing a point surveyed at the planned location 5-5
Editing a logged point 5-8
Editing a planned point surveyed through offset procedure 5-9
Offset Tab 5-10
P1, P2, P3 or P4 tab 5-11
Editing a logged point surveyed through offset procedure 5-12
Exporting results in the desired format 5-13
Saving PCMCIA files on your computer 5-14
Post-processing the raw data collected during a job 5-14

Appendices

A. Introduction to GNSS A-1

GPS Constellation A-1

Signals A-2

Navigation Message A-3

GNSS A-3

GENERAL DESCRIPTION A-3

Purpose A-4

GNSS concept A-5

The different systems A-6

B. Introduction to the DSNP Scorpio 6000 series B-1

Preamble B-1

The heart of your equipment B-2

Operating environment B-2

The clues to product naming in the Scorpio 6000 Series B-2

Product applications B-3

Product Selection Guide B-4

Specifications B-5

Physical B-5

Electrical B-5

Environmental B-6

Receiver unit standard features B-6

Built-in UHF receiver (for 600x MK) B-6

Plug-in UHF transmitter (for 600x SK) B-7

6001 MP/6001 SP specific performance data B-7

6002 MP/6002 SP specific performance data B-7

6001 MK/6001 SK specific performance data B-8

6002 MK/6002 SK specific performance data B-8

Block Diagrams B-9
- 6001 MP & 6001 SP B-9
- 6002 MP & 6002 SP B-10
- 6001 MK Rover Unit B-11
- 6001 SK Base Station B-12
- 6002 MK Rover Unit B-13
- 6002 SK Base Station B-14

C. KART/LRK General Principles C-1

KART C-1
- Theory of operation C-1
- Characteristics C-3

LRK C-4

D. Base Station Control D-1

Introduction to Palmtop software D-1
- Palmtop display D-1
- Keys and menus D-1

Getting started D-6

Station Control D-8
- Antenna D-8
- Position D-9
- Transmitter D-12
- Average position D-13

File Management D-15
- Memory D-15
- Raw Data D-17
- Sessions D-18
- Notes D-22

SVs D-24
Visible Constellation D-24
Deselection D-26
Coordinate System Used D-27
Datum D-27
Projection D-28
Change to WGS84 ..... D-28
Load Geodesy D-29
Local Grid D-30
Height correction D-31
System Tools D-32
Time D-32
Configuration D-33
Unit D-33
Release D-33

E. Notation rules used in SVAR and SBIN formats E-1

SVAR E-1
Reserved characters E-1
Conventions used E-1
General form E-2
Rule about numerals E-2
Rule about labels E-3
Error check rule E-3
SBIN E-4
Reserved characters E-4
Conventions used E-5
Symbols used E-5
General form E-5
Error check rule E-6
Rule about numerals E-6

F. GPS Raw Data in SBIN format F-1

SBIN@R : Single-frequency GPS pseudoranges in satellite time F-1

SBIN@R : Dual-frequency GPS pseudoranges in satellite time . F-4
SBIN@A: Almanac data F-9
SBIN@E: Ephemeris data F-10
SBIN@U: Iono/UTC data F-11
SBIN@S: Health & A/S data F-11

G. Results files in ASCII SVAR format G-1

File Header G-1
Points list G-2
Kinematic re-initialization G-8
Datum G-9
Projection parameters G-9
Tangent conical projection (Lambert): G-11
Secant conical projection (Lambert) G-12
UTM projection (Universal Transverse Mercator) G-13
Oblique cylindrical projection (Skew Orthomorphic) G-14
Oblique cylindrical projection (Rectified Skew Orthomorphic) G-15
Oblique stereographic projection (Skew Stereographic) G-16
Altimetric parameters G-17
Unit code G-18
RES file example (extracts) G-19

H. Troubleshooting &Software Installation H-1

GNSS Receiver Status Display H-1
Introduction H-1
Screen No.0: Operating Status H-2
Screen No. 1: Error report H-3
Screen No. 2: Position solution H-4
Screen No. 3: Time information H-5
Screen No. 4: GNSS reception status H-5
Screen No. 5: Information about sessions H-6

Screen No. 6: Information about corrections H-7
Screen No. 7: Differential corrections H-8
Screen No. 8: Firmware installed H-9
Screen No. 9: Hardware and Software identification H-10

GNSS Receiver Front Panel Indicators H-11

GNSS Receiver Error report H-11
Error families H-12
Error classification H-12
Error list H-13

GNSS Receiver Rear panel Connectors H-16
RS232 cable H-19

FSGS Palmtop Computer H-20
FSGS Palmtop Configuration H-20
Software loading H-21
Maintenance steps H-23

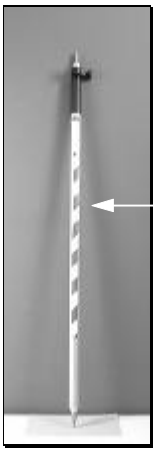
1. Unpacking & Description

1

6001/2 MK Rover Unit

Unpacking

The supply consists of a container and a telescopic pole provided separately.



Telescopic Pole 1337-L,
Part No. 3310203

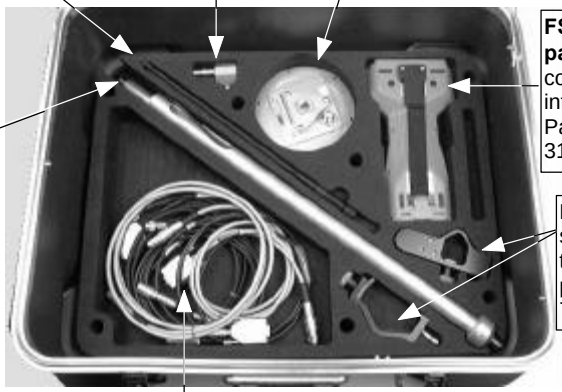
Open the container. This item, marketed under the Part No. 790077805, includes the container as such + the inner foam trays used to secure the various parts in the container.

List and inspect all the parts provided. Should parts be missing or damaged when first opening the container, please contact your distributor. DSNP reserves the right to make changes to the standard supply described below without prior notice.

FSP70, 0 dB flexible **UHF antenna**
3310190 (415/435 MHz)
or 3310196 (430/450 MHz)
or 3310188 (450/470 MHz)

Quick release adapter
Part No. 26I2076528

GPS antenna:
NAP001 (L1) Part No.26E1076311 or
NAP002 (L1/L2) Part No. 26E1076208
with 5/8" adapter Part No. 724076577

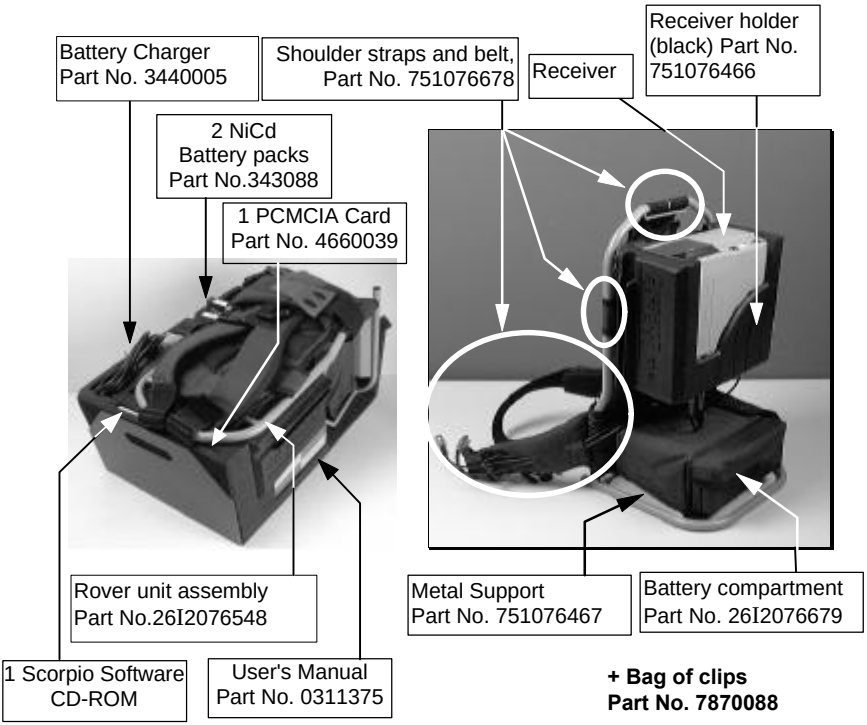


FS/GS palmtop computer and internal battery Part No. 317076375

Palmtop support for telescopic pole, Part No. 7510423

FS/GS palmtop cable, pp/SubD Part No. 605076501, 1.0 m
FS/GS-PC cable, SubD9/SubD9 Part No. 605076502, 1.0 m
GPS coaxial cable (pp/TNCm) Part No. 505076500, 1.5 m
UHF coaxial cable (TNCm/TNCm) Part No. 5050227, 2.50 m

Mast for UHF antenna Part No.
26I2076840
(includes UHF
coaxial cable
Part No. 505076499)
+ Mast for GPS antenna
Part No. 26I2076564 (not visible
on the photo)



The rover unit assembly (Part No. 26I2076548) consists of the following parts:

- the 6001 receiver Part No. 26I1076437or 6002 receiver Part No. 26I2076433
- the stand, Part No. 26E1076942, which consists of the receiver holder (Part No. 751076466, black rubber), the Metal support (Part No. 751076467) and small parts (screws, washers, standoffs).
- the battery compartment, Part No. 26I2076679 (which includes 2 battery cables Part No. 605076507)

- Shoulder straps and belt, Part No. 751076678, including a serial line cable (605076509, 0.75 m) and a GPS antenna cable (605076510, 0.75 m, coaxial, 50 Ω).

Note the presence of two cables in the belt at delivery. Do not remove them as they are precisely required at this location for your field surveys.

They do not need to be removed either when putting the rover unit assembly back into its container for transportation.

1

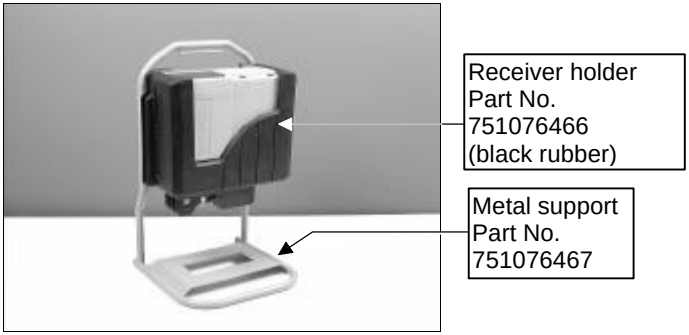
6001/2 SK Base Station

Unpacking

The standard supply consists of the following items (DSNP reserves the right to make changes to this list without prior notice):

- GPS station kit Part No. 26E1076434 (adapters, Meter Kit, and other small parts)
- Station container Part No. 790077806 (consists of the container as such + the inner foam trays used to secure the various items in the container):

- Receiver holder Part No. 751076466 (black rubber) and metal support Part No. 751076467:



UHF antenna whip (from GP450-3 antenna Part No. 3310202)

Ground plane (from GP450-3 antenna Part No. 3310202)

UHF antenna mast element, 50 cm Part No.735076661

Adapter assembly composed of:
- GAW600 Tripod adapter Part No.3310205
- GAF 5/8" adapter Part No. 3310206

FMP40 antenna mount kit Part No. 3310115

Allen wrench (for assembling the UHF antenna)

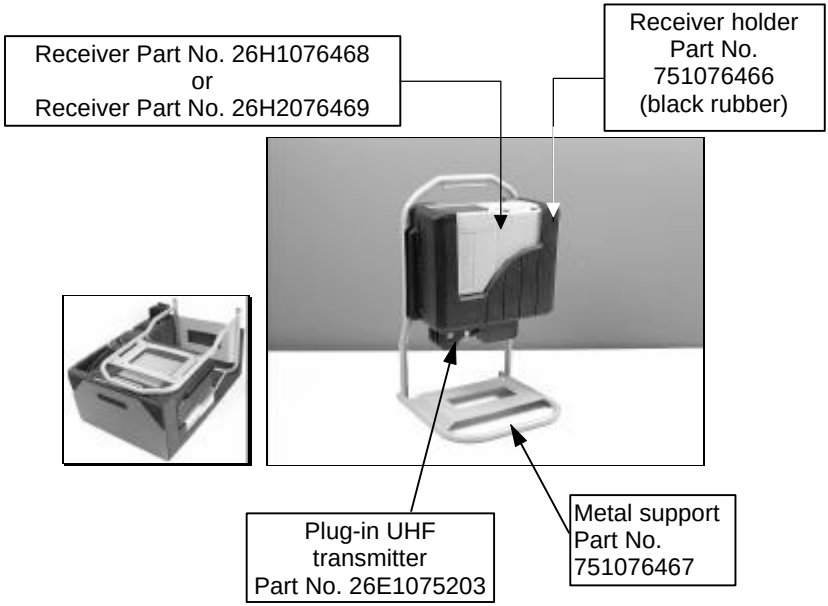
GPS antenna:
NAP001 (L1) Part No.26E1076311
or
NAP002 (L1/L2) Part No. 26E1076208
with
5/8" adapter Part No. 724076577

Meter Kit (2 parts) Part No. 26I2076601

Set of cables:

1 power cable, 2 m	Part No. 605076503
1 RS232C cable, 2m	Part No. 605076570
1 × 10-metre GPS coaxial cable (TNC-m/TNC-m)	Part No. 5050196
1 × 6.50-metre UHF coaxial cable (N-m/N-m)	Part No. 5050197

1



Station stand Part No. 26E1076942 consists of the receiver holder, the metal support and small parts (screws, washers, standoffs).

GNSS receiver description

The GNSS receiver used both at the base station and as the rover unit is fitted with the following parts on its front and rear panels.

Front Panel

- **Front panel controls**

ON/OFF push-button : used to switch the receiver ON (brief press) or OFF (long press)

The indicator light nested in this button starts blinking when you press the button (if the receiver is connected to a power source). From the end of the self-tests, the light is permanently ON.

Scroll push-button : used to access the different data screens available from the status display.

Activates the screen light for 30 seconds whenever depressed.

A long press on the **Scroll** push-button allows you to return to screen No. **0**.

- If the receiver is used as a rover unit, the indicator light nested in the button provides the following information:

  ON : Data recording on PCMCIA in progress

  OFF : No data recording

- If the receiver is used at a base station, the indicator light nested in the button provides information about the possible planned sessions or session in progress as soon as you connect the receiver to the power source:

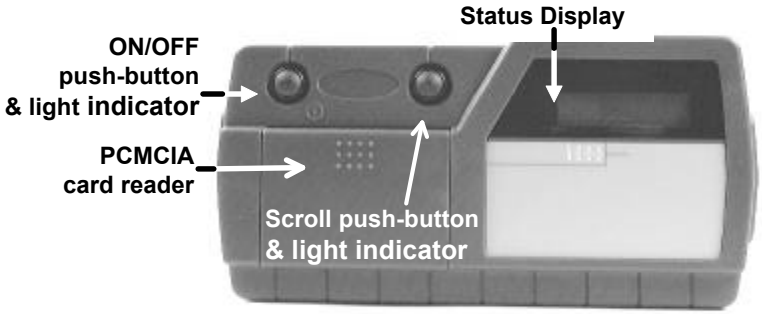
1

Blinking : A session is programmed to be run at a later time & date.
A few minutes before starting the session, the receiver will be automatically turned on, unless meanwhile this is made manually by the operator (who presses the ON/OFF button) or unless the power supply mode has been set to "MPW" (refer to *Appendix D* for more information about this parameter).

ON : An operating or recording session is in progress. The other indicator light is necessarily ON.

OFF : No pending session. The receiver will be powered only manually by using the ON/OFF button.

Status Display : 2-line×16-character display providing information about receiver operation (for a complete description of the displayed data, see *Appendix H*).



- **PCMCIA card reader**

  A PCMCIA card reader is located in the left-hand part of the front panel.

  This device has reader/recorder capabilities.

  The PCMCIA card is seen from the DSNP GNSS engine as a conventional serial port (port P).

Rear panel

The rear panel is fitted with the following connectors:

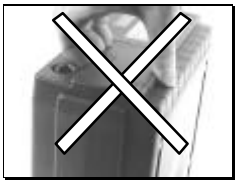
- A GPS coaxial connector (GPS antenna input), TNC-female type
- A DGPS coaxial connector (DGPS antenna input), TNC-female type
- Two RS232 connectors (port A named "COMPUTER"; port B named "I/O")
- An RS422 connector (port D named "DGPS"), 15-C SubD-female type, used to connect the plug-in UHF transmitter (base station only)
- Two POWER connectors in parallel. This allows the receiver to be maintained in operation while you swap the power source. For example, in the case of a battery-powered receiver, you can connect the new battery before removing the low one.

1

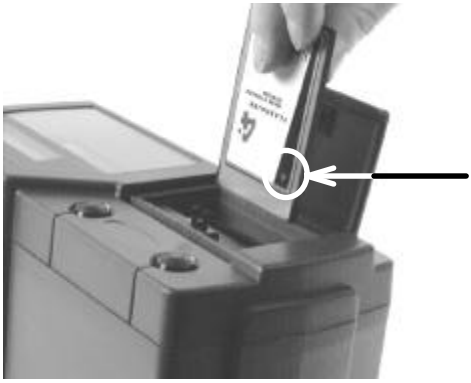
PCMCIA Drive

Inserting a PCMCIA card

- Unlock the cover by applying a finger on its upper-middle part and then by pushing it. The cover will open when you remove your finger.



- Orient the PCMCIA card as shown below.
- Insert the PCMCIA in the slot and push gently until you hear a click (indicating that the card is locked in the reader).



- Close the cover (a click indicates that the cover is locked) by pushing the cover, *in the same way as you did previously to open it*.

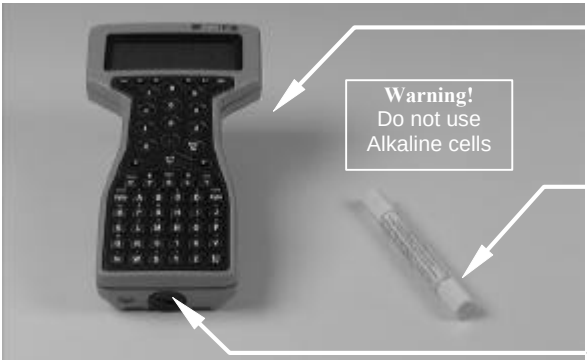
Removing a PCMCIA card

- Unlock the cover.
- With a finger, depress the black, square-shaped, knob located to the right of the reader until the card is released.

- Take the card out of the reader.

1

FSGS Palmtop Computer



FSGS Battery Pack

The FSGS has been configured in order that battery charging can take place from a power source present on its RS232C connector.

After connecting a non-powered FSGS to an operating (powered) receiver, the "`Charging in progress`" message should appear on the FSGS display. If not so, please refer to *Appendix H*.

At equipment delivery, the FSGS is fitted with a NiCd battery pack so there is no particular precaution to be taken. If later, for any reason, alkaline cells have been placed inside the palmtop, the first thing you will have to do *before using the palmtop attached to the receiver* will be to *replace these cells with the NiCd pack*.

Warnings!

To avoid pressurization problems inside the FSGS if it is taken on an airline trip, the battery cap has been loosened before shipment. Do not forget to lock this cap as this is required to maintain proper sealing. If you have to travel by air with your equipment, do the same (loosen the cap before take-off, lock it back after landing).

Do not charge the NiCd battery pack outside the 5 to 40° temperature range.

FSGS temperature ranges

- Operating: – 20°C to +55°C
- Storage: – 30°C to +70°C

Environment

The FSGS is designed to operate in conditions of up to 90% relative humidity. The internal humidity indicator strip, visible in the bottom-right corner of the display window, should be blue. If it takes on a pinkish color, please remove the NiCd battery and return the palmtop to the servicing department.

Trickle-charged internal battery

A trickle-charged internal battery is fitted, which provides back-up power to preserve the data on the RAM disk for at least 2 weeks if the main power source (i.e. th NiCd battery) is removed. This auxiliary battery, charged with a trickle current from the NiCd battery, does not normally need to be replaced.

Cleaning

Clean the LCD screen with a clean cloth. Do not use solvent cleaners or harsh detergents. If the case is very dirty, make sure the battery cap is tight, then wash it gently under warm running water. Leave it to dry in a warm room. Do not use forced air drying.

Long-term storage

If you intend to store the FSGS for at least 2 months, remove the NiCd battery and fit a fresh set of 3 highest quality Alkaline cells. We recommend storage at a temperature between 10°C and 35°C. Alkaline cells should be changed every 6 months.

1

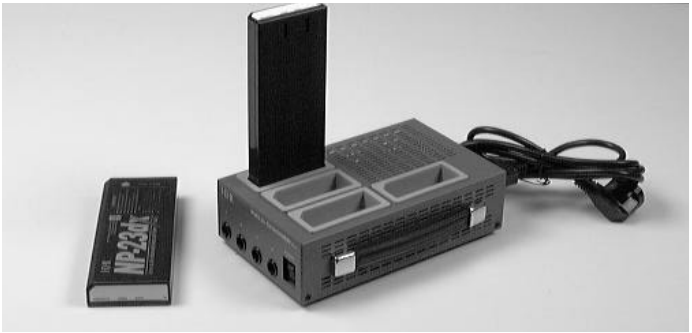
After long-term storage

Remove the Alkaline cells and insert the NiCd battery after fully charging it.

Changing the NiCd battery

- Turn off the FSGS (press the red key, top right)
- Use a coin to undo the battery cap (turn counter-clockwise)
- Remove the old battery
- Fit in a new battery, positive end first
- Take the battery cap and, with finger pressure only, press it into the battery compartment and turn it clockwise.
- Only when the thread is started, use a coin to screw the cap tightly home.

Preparing batteries for the Rover Unit



- Use NiCd batteries only.
- Approximate charging time: from 1 hour to 1 ¼ hour per battery
- A single battery pack is charged at a time.

♣

2. Preparing a project

Introduction

Preparing a project requires the use of the *KISS* module from the DSNP *3SPack* software package.

In this section, we will just outline the main steps of a project preparation using this module. It is assumed that the DSNP *3SPack* software package has been properly installed and the dongle allowing the PC to run that package has been connected to the parallel port.

For detailed information on how to install *3SPack* and how to use *KISS*, please refer to the corresponding manual (*3SPack Reference Manual*, Part No.0311366).

Creating a project

Assuming *KISS* is now running on your PC, do the following:

- In the Toolbar, click or, from the menu bar select **File** and then **New**, or double-click on the following icon in the Projects window:

- Start defining your project by completing the **Project Wizard-Welcome** Dialog Box which then appears.

Project	Enter the project name
Region	Enter the region name (optional)
Center Easting	Enter the Easting of the center point
Center Northing	Enter the Northing of the center point
Scale	Choose a pre-defined value from the combo box or type another value in the text box
Distances in	Choose the distance unit from this combo box (meters, US feet or imperial feet)
Angles In	Choose the angle unit from this combo box (degrees or grades)
Notes text box	Add comments or recommendations of any kind which you want to associate to this project (optional).

- Then, click the **Next>** button.
- Complete the **Project Wizard-Horizontal System** Dialog Box which then appears. In usual cases, you just have to select a projection from the **Projection** combo box, which lists all the projections available from the 3SPack database.

  If you do not know which projection should be used, select <Unknown> in the PROJECTION combo box. As a result, KISS will also set the ON DATUM combo box to <Unknown>. You can however change this setting if you know the datum.

  The inverse statement is also possible: you can choose a projection and leave the datum “<Unknown>”.

As you can see, all the combinations are possible. However the most typical ones remain “projection and datum known” or “projection and datum unknown”.

When you select a projection or datum, in fact you load it from the 3SPack database. All the parameters of this projection or datum then appear in the dialog box.

If necessary, you can adjust the values of some of these parameters. If you do so, we recommend you to change the name of the projection or datum as well (the PROJECTION and ON DATUM combo boxes are also editable fields). In this way, you will never forget that you derived your horizontal coordinate system from a standard one. **WARNING!** This new system will be stored in your project only, not in the 3SPack database.

The different parameters of projections and datums shown in this tab are described below.

PROJECTION Combo box listing the projections stored in the 3Spack database. Select the name of the projection used. As a result, the rest of the dialog box is updated to match your selection. This combo box is also an editable text box (see above)

Proj Kind From this combo box, select the kind of projection used. Generally this selection is correct after you choose the PROJECTION name (above)

False East. Easting of projection center

False North. Northing of projection center

Central Merid. Longitude of projection center

Central Lat. Latitude of projection center (except for 2P Lambert)

Scale Scale factor (except for 2P Lambert)

North Lat. Latitude of 1st parallel (for 2P Lambert only)

Ref. Lat. Latitude of projection center (for 2P Lambert only)

South Lat. Latitude of 2nd parallel (for 2P Lambert only)

Skew Azimuth of initial line (for Rect Skew Ortho and Skew Ortho only)

ON DATUM Combo box listing the datums stored in the 3Spack database. Select the name of the datum used. As a result, the rest of the dialog box is updated to match your selection. This combo box is also an editable text box (see above)

K Scale factor

Dx X deviation from ellipsoid (signed value in m)

Dy Y deviation from ellipsoid (signed value in m)

Dz Z deviation from ellipsoid (signed value in m)

A Semi-major axis of the ellipsoid, in m

1 / F Inverse flattening coefficient (ellipsoid)

Rx Angular deviation around X axis of ellipsoid (in seconds)

Ry Angular deviation around Y axis of ellipsoid (in seconds)

Rz Angular deviation around Z axis of ellipsoid (in seconds)

- If a local grid must be used, proceed with the settings below.

WITH LOCAL GRID
check button — Button cleared: no local grid

Button checked: enter the parameters of the local grid:

E0	Easting of origin
N0	Northing of origin
K	Scale factor
DE	Easting shift
DN	Northing shift
Beta	Rotation angle

- Then, click the **Next>** button.
- Complete the **Project Wizard-Vertical System** Dialog Box which then appears. In this box, tell KISS whether the altitude of the surveyed points should be expressed in relation to a geoid (Stanag Model) or a datum (WGS84, or the one selected for the project). For special settings in this dialog box, see below.

HEIGHT EXPRESSED ON Choose the reference upon which the altitudes of the surveyed points will be determined.

If you click the **GEOID** radio button, then the reference can only be the Stanag model (see combo box nearby), as this is the only geoid model available today

If you click the **DATUM** radio button, then the reference can be either the datum used in the horizontal system, or the WGS84 (selection in same combo box nearby)

WITH LOCAL CORRECTION...

check button — Check this button if corrections have to be made to the selected reference (otherwise keep it cleared):

- **dH** Vertical deviation between vertical system and WGS84 at the origin
- **Gl** Latitude gain (a coefficient)
- **Gg** Longitude gain (a coefficient)
- **L0** Latitude of the origin
- **G0** Longitude of the origin

Before you end the definition of the project, you can still go back to the previous tabs by clicking the **<Back** button if changes have to be made in these tabs. Then use the **Next>** button again until the **Finish** button appears.

· Once you agree with the definition of the project, click the **Finish** button. KISS then creates the new project. A map of the region of survey appears in the KISS window. In the same time, the project is saved in the KIS directory

- Proceed with the definition of your project as such:

1 Place your reference points on the map (see page *2-8*)

2 Place your target points on the map (see page *2-10*)

3 Write jobs to PCMCIA cards (see page *2-13*).

Terminology used

The term “target” is used in two different contexts:

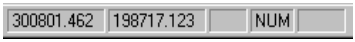
1. To designate a point whose location is known in theory and which has to be materialized in the field. In this case the term “target” is always associated with the term “point”
2. To designate the supposed (or planned) position of any point, whether a target point or a reference point. In this case, the term “target” is used alone. The main contexts in which “target” appears with this meaning are:
    - In the **General** tab of any dialog box describing a reference point
    - In the **General** tab of any dialog box describing a target point
    - In the **Edit** menu, **Import Target** and **Export Target** commands

Placing reference points on the map

With your project now open in the KISS window, do the following:

- In the toolbar, click or from the **Draw** menu, select the **Reference points** command.
- Move the mouse pointer (then a) onto the map where you want to create a new reference point.

  In the lower part of the window, the status bar helps you locate the point accurately on the map by giving the current coordinates of the mouse pointer as you move it within the window:

- When the mouse pointer is at the desired location, click with the left mouse button. This causes a dialog box to appear in which you should complete the definition of the point:

Name — Keep the default name of the reference point or type another name

Code 1... code 4 — Optional. Enter or select a geocode from each of these combo boxes. The list of available geocodes is the one you can define from the **KISS Options** dialog box, **General tab**

Note that if you place the pointer on the down-arrow of any of these combo boxes, the meaning of the selected geocode will appear in a tip box.

Target/Result/Error radio buttons — At this stage, only the **Target** radio button is checked as the field survey is still to come

E N H check buttons — They define the type of the reference point. Three types are possible:

1D point: Obtained by checking the **H** button and clearing either of the other two buttons.

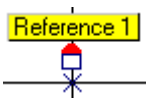
2D point: Obtained by clearing the **H** button and checking either of the other two buttons. The **E** and **N** buttons are then checked.

3D point: Obtained by checking the **H** button and either of the other two buttons. All three buttons are then checked.

E N H text boxes — Planned coordinates of the reference point resulting from where you clicked on the map. If you change **E** or **N**, the icon will appear at a location different from where you clicked. Any change in these boxes should be consistent with the type of point (1D, 2D, 3D) you choose (see **E N H** check buttons just above).

Notes pane: — Add comments or recommendations of any kind which you want to associate to this point (optional).

- When the definition is complete, click the **OK** button. This causes the dialog box to disappear, and a new Reference Point icon to appear on the map:



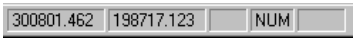
- Create other reference points if necessary using the same procedure. Do not forget to save the project at regular intervals by clicking in the toolbar.

Placing target points on the map

With your project still open in the KISS window, do the following:

- In the toolbar, click or from the **Draw** menu, select the **Target points** command.
- Move the mouse pointer (now a) where you want to create a new target point.

  In the right-lower part of the KISS window, the status bar helps you locate the point accurately on the map by giving the current coordinates of the mouse pointer as you move it within the window:

- When the mouse pointer is at the desired location, click with the left mouse button. This causes a new Target Point icon to appear on the map:

  A default name, of the type "Target nn", is assigned to the point. "nn" is the order number (nn=1 if first point created, =2 if second point created, etc.).

- **Editing the properties of a target point you have just placed on the map**

  - In the toolbar, click or from the **Draw** menu, choose the **Select** command.
  - Double-click on the icon corresponding to the target point you want to edit. A dialog box appears showing the properties of the target point. At this stage, the dialog box consists of a single tab (General).

Name	Keep the default name of the target point or type another name
Code 1... code 4	Optional. Enter or select a geocode from each of these combo boxes. The list of available geocodes is the one you can define from the **KISS Options** dialog box, **General tab** Note that if you place the pointer on the down-arrow of any of these combo boxes, the meaning of the selected geocode will appear in a tip box.
Target/Result/Error radio buttons	At this stage, only the **Target** radio button is checked as the field survey is still to come
E N H check buttons	They define the type of the target point. Two types are possible: . 2D point: Simply obtained by clearing the **H** button. . 3D point: Simply obtained by checking the **H** button.

E N H text boxes	Planned coordinates of the target point resulting from where you clicked on the map. If you change **E** or **N**, the icon will appear at a location different from where you clicked. Any change in these boxes should be consistent with the type of point (2D, 3D) you choose (see **E N H** check buttons just above).
Notes pane	Add comments or recommendations of any kind which you want to associate to this point (optional).
"Target" diagram (on right)	The "target" (planned location) is shown at the center of an oriented circle whose radius is the **Acceptable deviation between target and surveyed coordinates** defined in the **General tab** of the KISS options.

- Create other target points if necessary using the same procedure. Do not forget to save the project at regular intervals by clicking in the toolbar.

Preparing PCMCIA cards for field operators

With your project open in the KISS window, do the following:

- Insert a card into the PCMCIA drive of your PC.
- If you want to focus on particular points, then select the corresponding icons. If that is not the case, do not make any selection
- In the toolbar, click or, from the **Transfer** menu, select the **Write Job** command.
- In the **Write Job...** dialog box which then appears, enter a name for the file which is going to be written to the PCMCIA (8 characters max.) or select an existing one from the list box which you will overwrite with the new job
- Specify the content of the job by checking one of the following buttons:

Selected Points : This option should logically be checked if you have made a prior selection of objects on the map (option dimmed otherwise)

Remaining Points : Check this option if you want the field operator to deal only with the points not surveyed yet (which supposes that a part of the project has already been made). With this option you do not need to make a prior selection of objects on the map

All Points : Check this option if you want to write the entire project to the card.

- Specify the order in which the points will be written to the PCMCIA by making a selection in the following combo box:

  In Order of Choose one of the possible ways of arranging the points in the job:

  Creation
  Name
  Kind
  Geocode 1...4
  Point size
  Target East.
  Target North.
  Target Height

- From the **For Operator** combo box, enter or select the name of the operator in charge of the job in the field. The list of known operators is defined in the **Options** dialog box, **General tab** .
- Click the **OK** button to write the job to the PCMCIA card.

  The file extension of a job file on PCMCIA is ”JOB”.

  ♣

3. Operating Instructions at the base station

Station installation

Although installing a base station is rather an easy operation, you should however be very careful in every detail of the installation. Indeed, how and where you install the base station and the antennas will greatly determine the level of performance you can expect from it.

You do not need particular tool, but your usual tool box.

Choosing a location where to install a base station

Remember the station should be installed in a place clear of any devices likely to produce radio-frequency interference or multipath effects.

GPS antenna

Consider the following two requirements in the choice of a location for the GPS antenna, the first one having priority over the second:

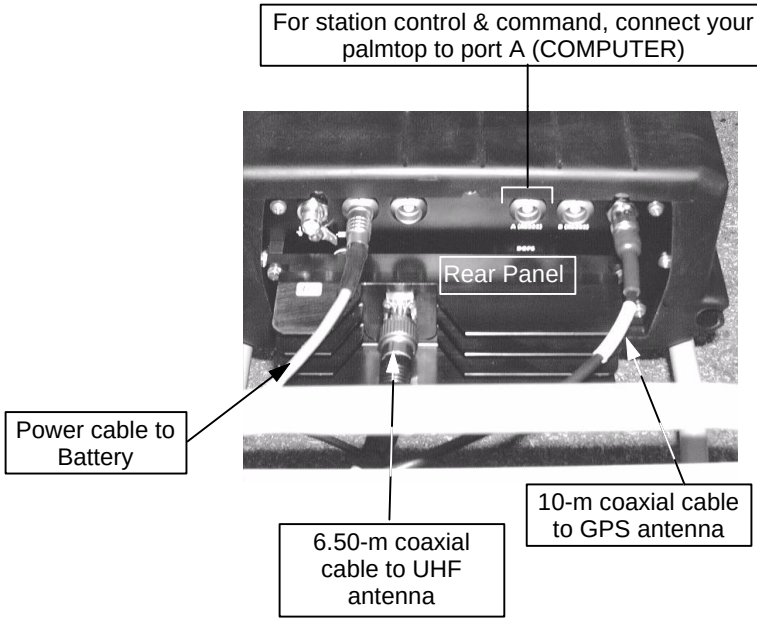
- For best reception, install the GPS antenna at a safe distance from high-power antennas and radio-transmitters. Choose a place providing a 360-degree view of the horizon.
- To save time in your surveys, you should better install the GPS antenna at an accurately known location, with its coordinates expressed in the coordinate system used for the surveys. If the antenna location is not known, you will have to let the station determine this location after running it in the *Average Position mode* (see page *3-10*, *Average Position mode*).

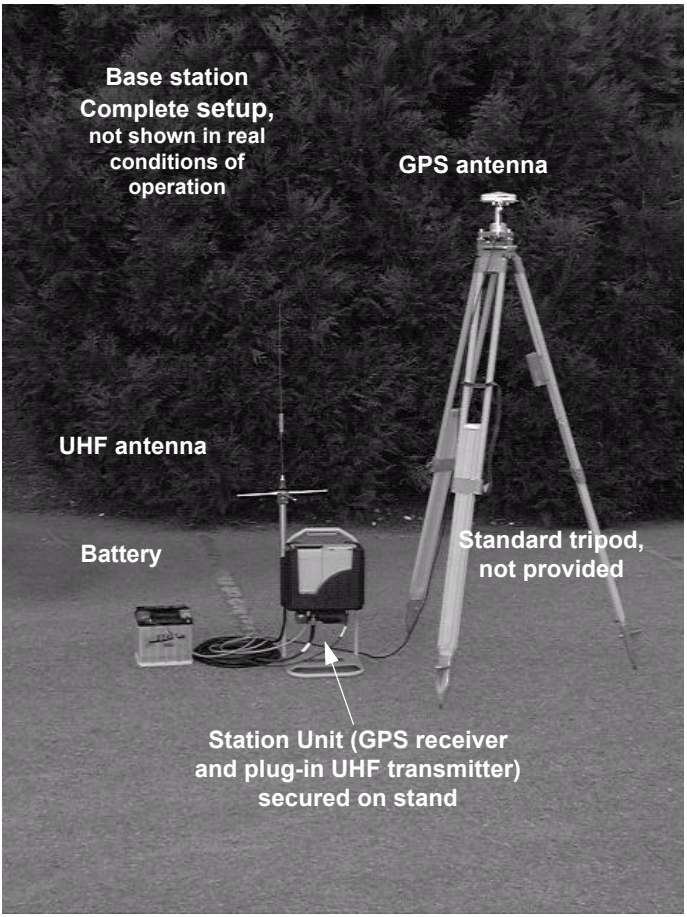
UHF antenna

The higher the UHF antenna, the better its coverage.

Avoid mounting the UHF antenna parallel to, or in the neighbourhood of other metal parts, such as masts, supporting wires, etc.

Connections and Setup




Base station
Complete setup,
not shown in real
conditions of
operation
GPS antenna
UHF antenna
Battery
Standard tripod,
not provided
Station Unit (GPS receiver
and plug-in UHF transmitter)
secured on stand

Measuring the GPS antenna height

When programming the station, you will need to know the height of the GPS antenna phase center above the landmark. There are two ways of measuring this height:

DSNP measurement

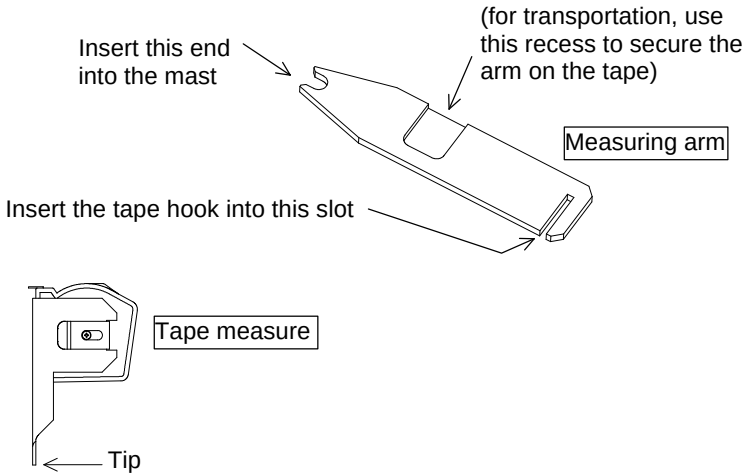
With this method, use the Meter Kit Part No. 26I2076601 as described below. The meter kit is composed of a tape measure and a measuring arm.

- Insert the measuring arm into the mast, just under the antenna base plane.

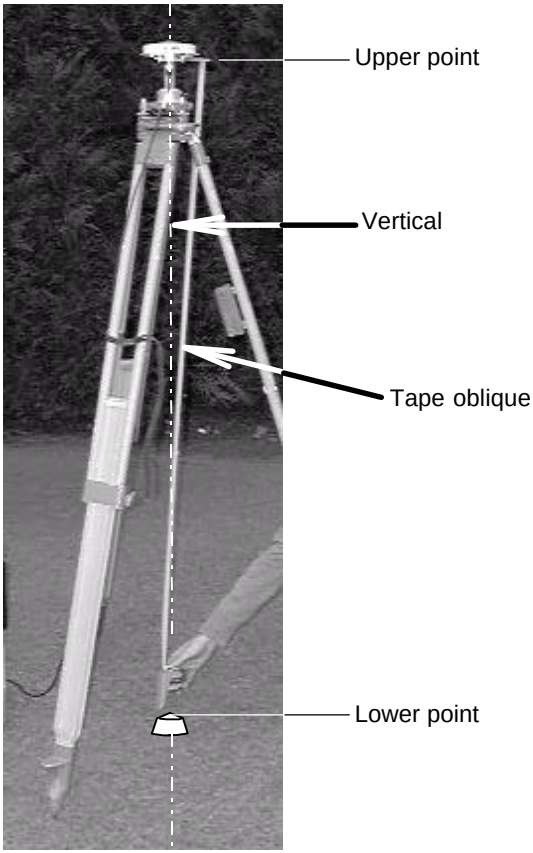
  Insert the tape hook into the measuring arm (upper point)

- Unwind the tape and place the tip onto the landmark (lower point)

- Write down the value read on the scale. This value will be entered later as the antenna height, with the DSNP measure option selected (see page *3-8*, *Measuring the GPS antenna height*).



- DSNP measurement:



USER measurement

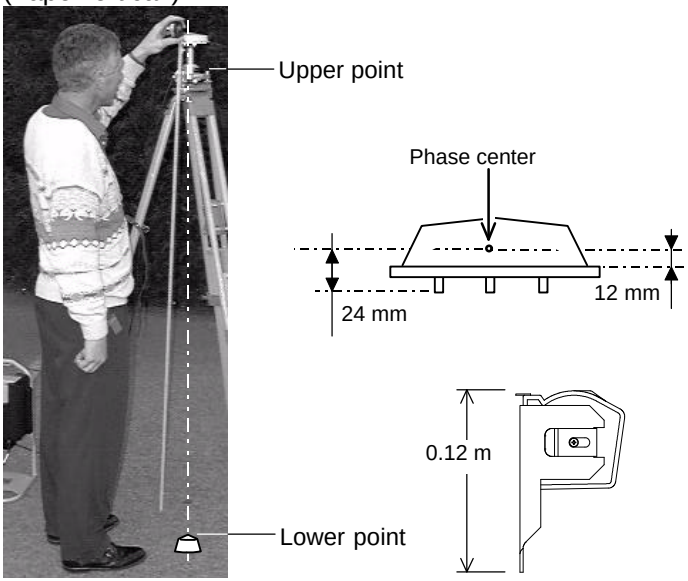
Knowing the location of the phase center in the GPS antenna, you can measure its height above the landmark with your own method:

If you find it easier, you can split the height measurement into two distinct vertical components which you measure one after the other.

For example, you can measure the height of the phase center above an arbitrary mark on the mast (1st measurement) and then measure the height of this mark above the land mark (2nd measurement).

You just need to use the tape measure for this kind of measurement.

USER measurement illustration (example)
(Tape vertical)



If, as opposed to the illustration above, the tape hook is placed on the upper point and the tape tip on the landmark, do not forget to add 0.12 m to the value you read on the scale.

Programming the base station (Quick Procedure)

Preamble

- If the station does not need to be programmed or re-programmed (somebody else did it for you), just press the ON/OFF push-button on the receiver front panel and then check that the station reaches its operational status by reading the information reported on the station's status display (screen No. 0, see *Appendix H*).
- If changes have to be made to the programming of the station, connect the palmtop and run the Palmtop software as explained hereafter.

  In this section, it is assumed that the software has been properly installed (if required refer to *Appendix H* for software loading). In addition, a complete reference documentation for this software, when used at a base station, is provided in *Appendix D*.
- Basically, a station can function in two different operating modes:
  - The *Average position mode*, in which the station is requested to provide a position solution of its own location at the end of a certain time, by continually averaging its position solutions collected over this period of time. This operating mode should be run only if the position of the station is unknown or insufficiently known. It should be run for some time and then the averaged position should be used to program the station in *UHF transmission mode*.
  - The *UHF transmission mode*, the normal operating mode for a base station, in which the useful data is transmitted to users through a data link operating in the UHF band.

Getting the Palmtop software started

After pressing the ON/OFF push-button on the receiver front panel and after checking that the station has reached its operational status (see screen No. 0, *Appendix H*), do the following:

- Connect the FS/GS palmtop to port A on receiver rear panel, using cable part No. 605076501.
- Switch on the palmtop by depressing the red key (upper right).
- After the DOS prompt has appeared, type in "T" (not case-sensitive) and press the "Yes" key (↵).

  Let the palmtop complete its self-tests, the end of which is denoted by the test bar graph disappearing from the palmtop display and the automatic selection of the **Antenna** function.

  Note that starting the program will automatically switch the receiver on if you forgot to do that before. However in this case, the self-tests on the palmtop will be longer.

Programming steps

- You will not be allowed to change the settings of the base station if it is currently transmitting or operating in Average Position mode.

• Entering the GPS antenna height

- This function is automatically selected on completion of the self-tests

  In other contexts, select by using ← or → to access this function. In the function menu which then appears select **Antenna** by using the ↓ key and then press ↵.

- Press ← until the upper-right field is selected
- Press → and from the selection menu which then appears, select **User** or **DSNP** depending on the measurement made (see page *3-4*)
- Move the cursor to the next field and enter your measurement. If you chose **User**, you may have to enter two measurements instead of one with **DSNP** (see illustration opposite the entry fields).
- Press ↵. The resulting true height of the antenna appears on the right.
- Press the **Esc** key to come back to the main menu

- **Loading the coordinate system from the PCMCIA**
  - Insert the PCMCIA prepared for the job into the GNSS receiver of the base station.
  - From the main menu, select by using ← or →.
  - In the function menu which then appears select **Load Geodesy** using the ↓ key.
  - Press ↵ to validate this function. The screen then indicates the names of the jobs contained in the PCMCIA.
  - Choose one and press ↵ again to let the program load the coordinate system from that job to the base station (loading is instantaneous).
  - Press the **Esc** key to come back to the main menu

- **Entering the station position**

  - From the main menu, select by using ← or →.
  - In the function menu which then appears select **Position** by using the ↓ key.
  - Press ↵ to validate this function.
  - In the new screen which then appears, enter the three coordinates of the station, expressed in the coordinate system used (indicated in top line). If they are not accurately known, enter approximate coordinates. You will then have to select the *Average Position* mode (see below). Note that this screen also indicates the current value of antenna height with respect to ground.

  The station position can also be loaded from a PCMCIA. In this case however you must check that the point loaded from the PCMCIA is expressed in the same coordinate system as the one currently used in the base station. After inserting the PCMCIA into the reader, do the following:

  - Select the **Position** function
  - Press the **F** key.
  - Select a file in the list which appears and then press →
  - Select the point you want to use and then press → again. This loads the coordinates of this point to the receiver as the position of the station

- **If the coords of the station are not accurate enough, select the Average Position mode and let the station operate in this mode for a time that you specify:**

  - From the main menu, select using ← or →.
  - In the function menu which then appears, select **Average Position** using the ↓ key.

- Press ↵ to validate this function.
- Press the **R** key
- In the edit box which then appears, type in the period of time (hh:mm) during which the station should operate in the *Average Position mode.*

  Choose this time according to the figures given in the table below.

Operating time in *Average Position mode*	Resulting uncertainty on station's coordinates
10 min	50 meters
30 min	30 meters
1 hour	20 meters
12 hours	5 to 10 meters
24 hours	< 5 meters

- Then press ↵. The base station then starts running in the *Average Position mode* (status in the upper-left field: **Running**)

  From this time, the coordinate fields on this screen will be updated as new solutions are available. At the end of the planned time (new status: **Stop**), they will contain the average coordinates of the station.

After the station has left the *Average Position mode*, do the following:

- Unless already done, from the main menu, select and then select **Average Position**.
- Press the **A** key to transfer the averaged position to the **Position** function screen. The station is now ready to operate in *UHF transmission mode*.

Warning! A wrong reference position for the base station will not allow the system to operate properly: rover unit initialisation will be long, or even impossible, and position solutions will be wrong.

It is therefore advisable to check the corrections computed by the base station (displayed on Screen No. 7) after entering its position. The values of corrections should be in the order of a few tens of meters.

- **Entering the transmitter characteristics, enabling the station to transmit**

  - From the main menu, select using ← or →.
  - In the function menu which then appears, select the **Transmitter** function.
  - From the screen which then appears, enter the following parameters:
    - Station ID number: identification number of the station. This number is part of the data conveyed through the UHF link. The rover unit will test this number before validating the data received
    - Carrier frequency: within the band 410-470 MHz, necessarily a multiple of 12.5 kHz
    - Transmission rate (1 to 6 seconds): the interval of time between any two consecutive transmit moments (the data update rate naturally results from this setting)
    - Transmission slot (1 to 4): defines the organization of the data link if several base stations are used concurrently. If a single base station is used, choose “1” for this parameter. If several stations are used (up to 4), assign a different number to each station
    - Data: choose the type of data transmitted by the base station (LRK, DSNP C P, DSNP C)
  - Press ↵ again to validate all these parameters
  - Press the **E** key to enable the station to transmit (resulting status word on the screen: ON)

    (later, from this screen, you will press the **S** key to disable transmission).

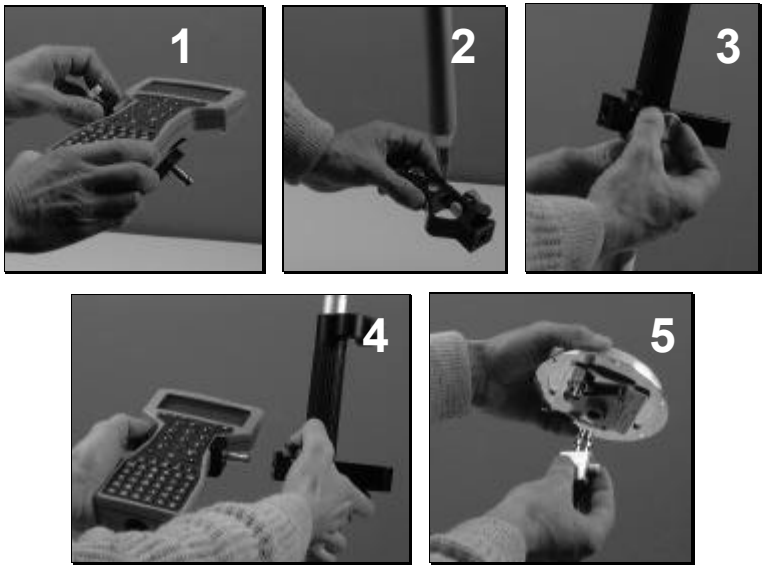
- **Programming the recording of raw data on PCMCIA, programming operating sessions**

  See *Appendix D*. ♣

4. Operating Instructions on the Rover Unit

Preparing for a field survey

Assembling the various parts



After inspecting all the parts provided in the container (see *Unpacking*, page *1-1*), proceed as shown above:

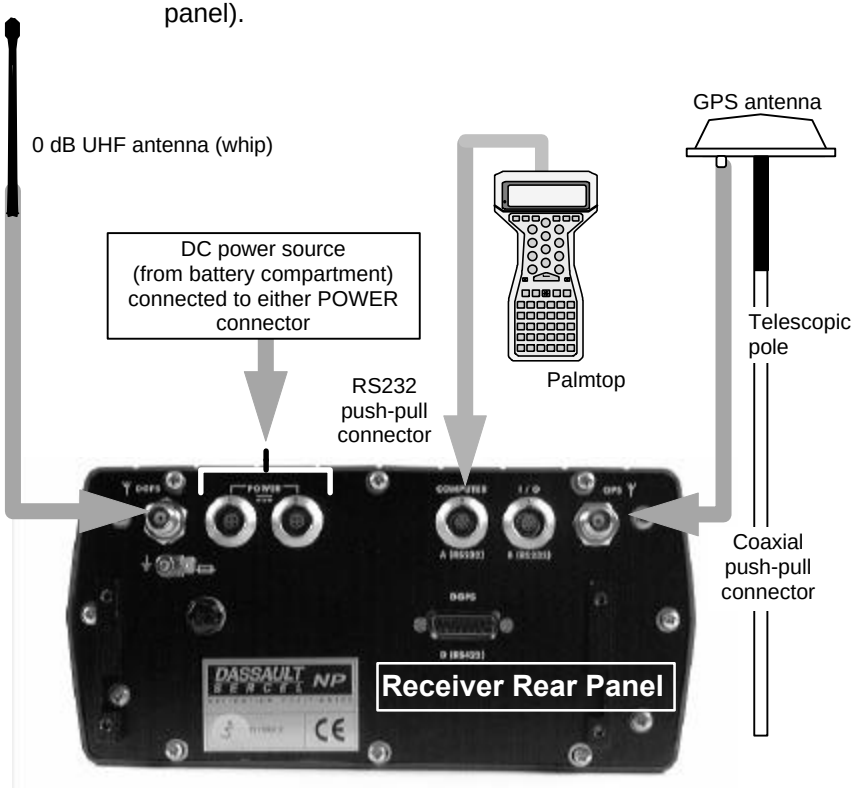
1. Secure the palmtop on its holder.
2. Insert the pointed end of the telescopic pole into the hole of the palmtop support.
3. Secure the support somewhere on the telescopic pole so that the palmtop be at a proper height (i.e. adapted to your own height).
4. With a thumb, depress the quick release button on the support and insert the tipped end of the palmtop holder into the support. Release the button.

5. Secure the quick release adapter in the lower part of the GPS antenna.

6. With a thumb, depress the button on the quick release adapter and insert the top of the pole into the adapter. Release the button.
7. Give the GPS antenna the desired height by adjusting the length of the telescopic pole.
8. Insert fresh battery packs into the battery compartment (a single way possible for battery insertion).
9. Do not forget to lock the battery compartment.
10. Screw the UHF antenna on top of the mast and insert the mast into the dedicated location on the receiver holder.
11. Make the necessary connections (described in the next page).

Connections

- Connect the end of the coaxial cable (protruding from the belt) to the GPS antenna.
- Connect the end of the serial line cable (protruding from the belt) to the palmtop.
- Make sure the palmtop is fitted with the NiCd battery pack.
- Connect the end of the coaxial cable protruding from the UHF antenna mast to the DGPS input (on receiver rear panel).



Getting ready for surveying

- Insert the PCMCIA containing the job into the receiver.

- Switch on the GNSS receiver by depressing the ON/OFF push-button.
- Put the rover unit assembly on your back
- Switch on the palmtop by depressing the red key (top right).

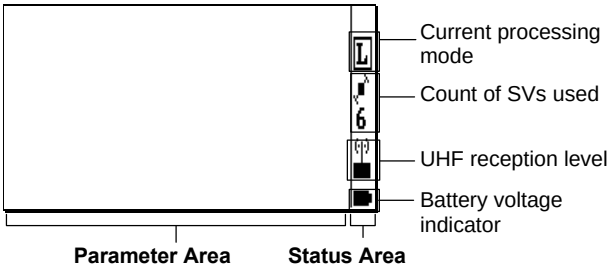
Operator ready for field operations:

Introduction to Palmtop Software

Remember you always use this program whether you are programming a base station or surveying with the rover unit. After detecting the type of the attached receiver, the program will configure itself to offer the right interface.

Palmtop Display

All screens are divided into two distinct areas as shown below. The status area is permanently shown.



Current processing mode:

H : Hold (no position solution)
I : KART or LRK initialisation
G : GPS
E : EDGPS (metric accuracy)
K : KART (centimetric accuracy)
L : LRK (centimetric accuracy)

Count of SVs used:

will blink if the count of SVs drops and remains below 4

UHF reception level icon:

: Minimum level required (blinking)
: 1 to 3 dB above minimum level
: 4 to 8 dB above minimum level
: 9 dB or more above minimum level

Battery voltage indicator:

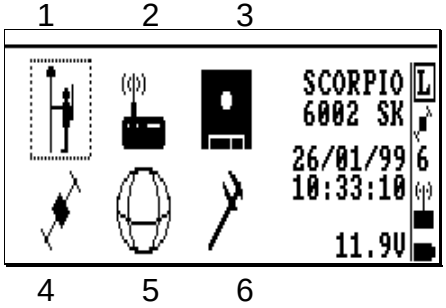
Below configurable threshold (blinking)
Above threshold (increment: about 0.1 V)
About 1 V above threshold

Keys and menus

A few keys and menu types need to be known for best use of the Palmtop Software program.

- **Main menu screen**

  The main menu shows the 6 groups of functions available in the form of icons (see below).



  Use the vertical- or horizontal-arrow keys (↑, ↓, →, ←) to select an icon. The selected icon is surrounded by dotted lines. Then press ↵ to enter the corresponding function. Alternately, you can directly enter a function by pressing the corresponding numeral key (see figures 1 to 6 in the screen example above)

- **Function menus**

  They are displayed after selecting an icon in the main menu and pressing ↵. Function menu example:

  - Using the vertical-arrow keys, select a function in the menu and then press ↵ again to run this function
  - Alternately, you can directly run a function by pressing the corresponding numeral key (se figures in the screen example above).
  - You can directly go from the Function menu of an icon to that of the next or previous one by pressing → or ←.

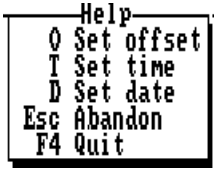
- **Help menus**

  There is a **Help** menu specific to almost each function, listing all the commands available in the context of this function.

  To display the **Help** menu, press the **F1** key. This causes the **Help** menu to be superimposed on the screen. Then do the following:

  - Press the key-letter to run the desired command.
  - or simply press the **Esc** key if you do not want to run any command. Incidentally, this will remove the Help menu from the screen

  For example, from the **Help** menu below, pressing the "D" key will directly display the screen allowing you to set the date.



  NOTE: You cannot view any **Help** menu while editing a parameter.

- **Other important keys**

  Esc

  - Pressing the **Esc** key will take you back to the preceding screen, or will remove the **Help** menu from the screen, or will cancel the change you make to a parameter. Repeated presses on this key will take you back to the main menu

  F2

  - From anywhere in the program, pressing the **F2** key will allow you to display the last solution computed for your current position (see screen example in page *4-74*).

Shift+F1

- From anywhere in the program, pressing **Shift+F1** will allow you to access the palmtop's notepad (see page *4-83*).

F4

- Pressing the **F4** key will allow you to quit the program. Confirm this choice by pressing ↵ (or press **Del** to cancel the request). Then a message is displayed asking you whether, in the same time, the receiver should be turned off (press the **Del** key) or not (press ↵).

• Making changes to parameters

Depending on the size and type of the parameters that can be changed, the program will use different scenarios to let you make that change:

- If the screen contains numerical or alpha-numerical parameters, a cursor (inverse video) will appear on the first of them.

  To change this parameter, simply type in the new value. Note that the position of the field on the screen will be shifted to the left while you edit it. If the size of the parameter is relatively long, an edit box will appear on top of the screen to show the entire field while you edit it.

  In both cases, the new value will be validated after you press ↵. Use ↓ or ↑ to access the next or previous field (respectively).

- If a parameter can only be set to some specific software-set values, then this field will be marked with a "▶". To know the possible values and choose one of them, use ↓ or ↑ to access this field and then press →. A select box appears showing these values. Use ↓ or ↑ to choose the desired value and press ↵ to validate your choice (the select box is removed from the screen at the same time). Alternately, you can directly type the numeral key corresponding to the row in which the desired value is shown (same as function menus, see page *4-6*).

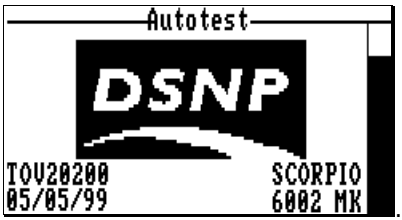
- **Messages and alarms**

  - The buzzer will beep in the following cases:
    - At the end of every auto-test
    - in case of LRK or KART re-initialisation
    - In case of invalid data entry or display request or other errors
  - Low battery alarm:
    - A beep will be heard and the "Battery is low" message will appear
    - Battery icon in the status area will blink until you change the battery
  - Satellite alarm:
    - Satellite icon in the status area will blink until 4 SVs or more can be received
  - Low UHF level alarm:
    - A beep will be heard when the reserve of UHF reception level drops below 3 dB
    - UHF reception icon in the status area will blink until reception conditions come back to normal
  - Communications problem with receiver:
    - A beep will be heard and the "Receiver not responding" message will appear

Getting started

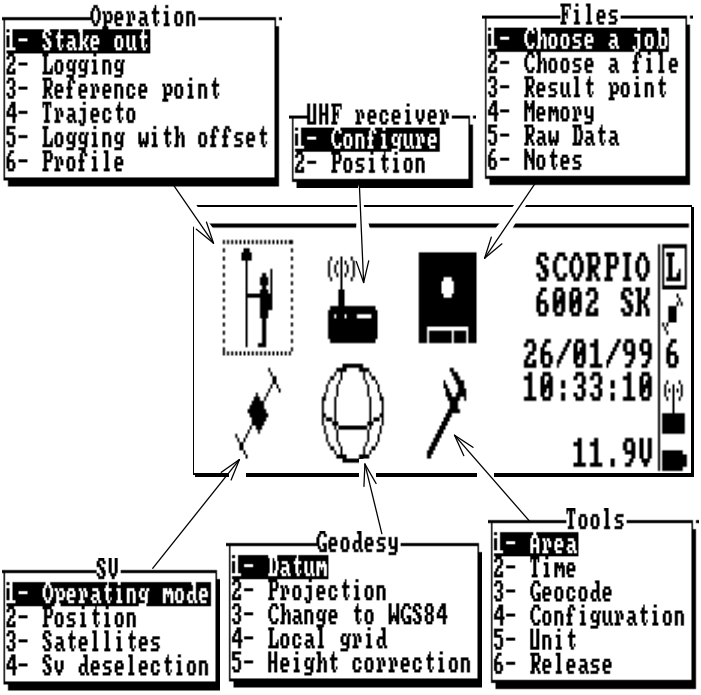
Assuming the rover unit is now ready and you have the palmtop in hand, do the following:

- From the DOS prompt, type in "T" or “t” and press ↵. The following screen appears denoting auto-tests in progress:



...

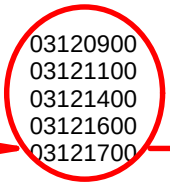
- At the end of the auto-tests, the **Choose a job** screen will appear asking you to specify the job you want to perform.
- Then the **Choose a file** screen will appear asking you to choose the file in which you want to record your survey (see next page for more information about these choices). Then the main menu will appear from which you can run any function you like. The diagram below reviews all the possible functions accessible from the 6 icons of the main menu.



- Use the vertical- or horizontal-arrow keys (↑, ↓, →, ←) to select an icon. The selected icon is surrounded by dotted lines.
- Press ↵ to validate your selection (or press the corresponding numeral shortcut key).

About *jobs* and *files*

All instructions for executing a job are contained in a job file:



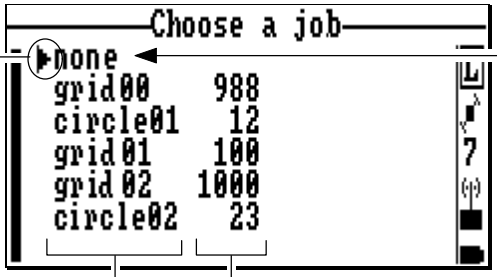
All the information concerning the points surveyed for a job is contained in a results file:

You can create up to 5 *files* to complete a job. These *files* are not files in the computer sense, but will appear as headers in the results file. Default name: mmddhhmm (month day hours minutes).

Data produced during the survey through each of these files is written to the same results file. Later, using KISS, you can retrieve just the necessary data by invoking the name of the corresponding *file*.

Choosing a *job*

When starting the rover unit, the screen corresponding to this function is automatically displayed at the end of the auto-tests.

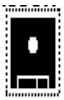


Cursor

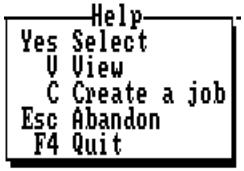
Choose "none" job name if you do not have any job to perform but you only want to access the main menu (for maintenance purposes for example)

Job name

Total number of points in the job

After completing a job, from the main menu, select  and then select **Choose a job** (1) to come back to this screen.

Associated **Help** menu:

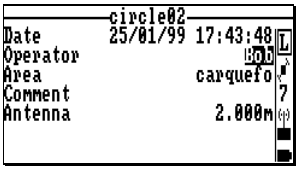


(Displayed by pressing **F1**, removed by pressing **Esc**)

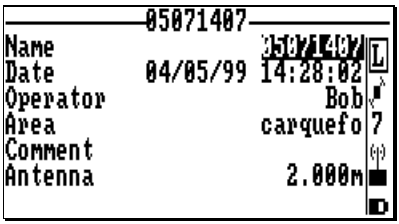
According to context:

- Press the **Yes** key (↵) to choose the job you marked with the cursor in the list of available jobs
- Or press the **V** key to view the properties of the marked job. The properties of a job are:
  - **Date** when job was created with KISS ((dd/mm/yy hh:mm:ss)
  - **Operator** name
  - **Area** name
  - **Comment**
  - Height of mobile GPS **Antenna**

  Job properties example, as viewed on screen:



- Or press the **C** key to create a new job directly in the field, without having to go back to the office and to resort to KISS. The screen which then appears allows you to define the properties of that job (see next page).



- Enter the following parameters:
  - Job name (12 characters max.; current time & date are prompted by default in the format “mmddhhmm”)
  - Operator’s name (your name)
  - Name of the working area (optional)
  - Any useful comment or note for the job (optional)
  - Height of the GPS antenna above the ground.

  Apart from the **Name** field, the default properties prompted for the new job are those of the previously chosen job (this applies to the **Date** field as well). On the other hand, the coordinate system assigned to the new job will necessarily be the one currently used in the receiver (without any possibility to change it).

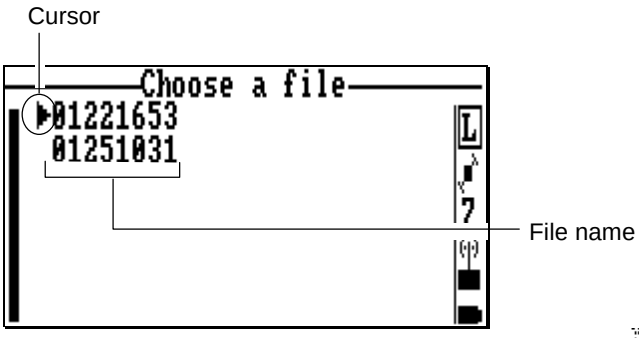
  The **Date** field can only be completed by software. When you create a new job, this field contains the creation date & time of the previously chosen job. Later on, when you view the properties of the job being created, then this field will contain the creation date & time of the job you are creating.

- Press the **F1** key to display the Help menu and select **Store** by pressing **F3**: this causes the new job to be created (you can also press **F3** directly):

  The palmtop then comes back to the **Choose a job** screen on which you can see the name of the job you have just created.

Choosing a *file*

When starting the rover unit, the screen corresponding to this function is automatically displayed at the end of the auto-tests after you have chosen a *job*.



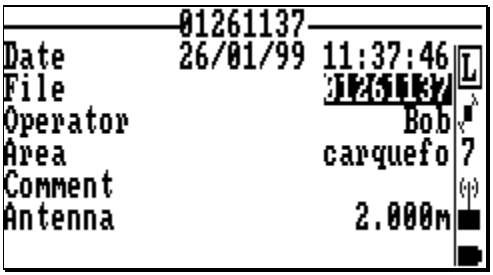
After completing a job, from the main menu, select and then select **Choose a file** (2) to come back to this screen.

Associated **Help** menu:

(Displayed by pressing **F1**, removed by pressing **Esc**)

According to context:

- Press the **Yes** key to choose the file you marked with the cursor in the list of available files. The screen then comes back to the main menu.
- Or press the **C** key to create a new file. A new screen appears allowing you to create this file (up to 5 files max. can be created for a job).



Apart from the **Date** field, which contains the current date & time (dd/mm/yy hh:mm:ss), all parameters on this screen can be changed. The default name assigned to the file is the current date & time (format: mmddhhmm). Press ↵ when you agree with the definition of the file.

- Or press the **V** key to view the properties of the file (same type of screen as the previous one).

4

Checking operating conditions before starting a survey

- Read the indications provided in the status area of the palmtop display (see also page *4-5*).

  Unless the **L** (or **K**) processing mode is now displayed in this area, wait for this letter to appear before proceeding with your work. When displayed, this letter denotes successful LRK (or KART) initialisation and the ability for the rover unit to perform a job. Proper initialisation is necessarily achieved with at least 4 satellites received and used

- Check the battery indicator. With fresh batteries, the icon shape should be as follows: ■

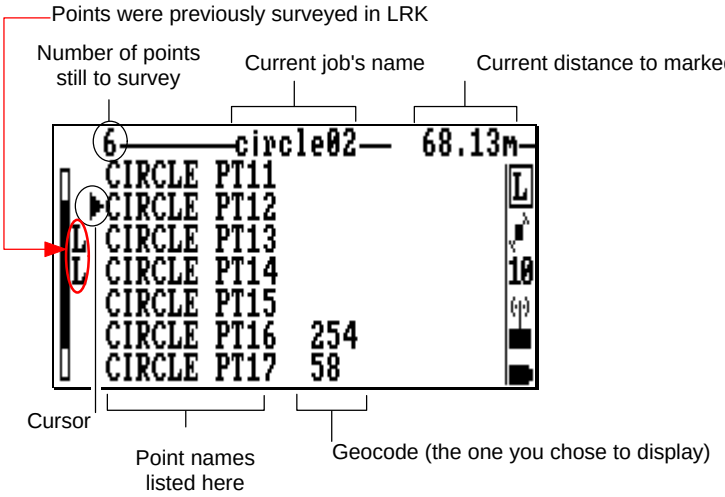
- Check the UHF reception level. The higher the reception level the better.

Surveying target points (Staking Out)

General case

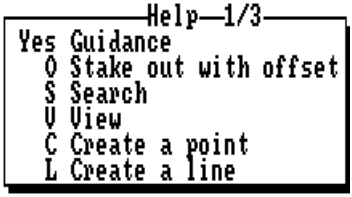
1. **Choose a job and a file** (as explained in pages *4-11* and *4-14*).

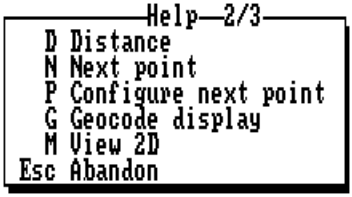
2. **From the main menu, select** **and then Stake Out (1).** The screen now shows the list of target points to be surveyed for the job

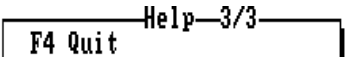


Associated **Help** menu (3 screens):

(Displayed by pressing **F1**, removed by pressing **Esc**. Press **PgUp** or **PgDn** to change help menu)







Guidance: see page *4-19*

Stake out with offset: see page *4-26*

Search: Press the **S** key to search for a new point (to be continued in page *4-64*)

View: Press the **V** key to view the definition of the selected point (see the 2 screens in the next page)

Create a point: Press the **C** key to create a new point (to be continued in page *4-64*)

Create a line: Press the **L** key to create a new line (to be continued in page *4-66*)

Distance: Press the **D** key to access the screen allowing you to measure the distance between any two points (see page *4-61*)

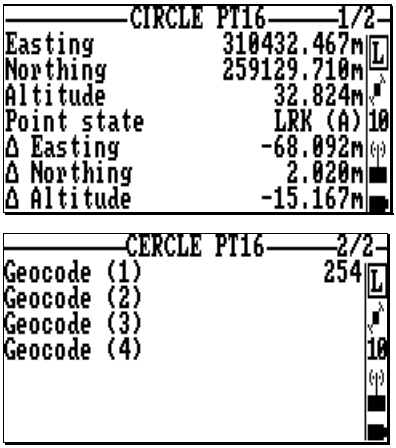
Next point: Press the **N** key to select the point you defined as the "next point" (see below)

Configure next point: Press the **P** key to define the nature of the next point (to be continued in page *4-63*)

Geocode display: Allows you to choose which geocode (1, 2, 3 or 4) should be displayed in the list of points

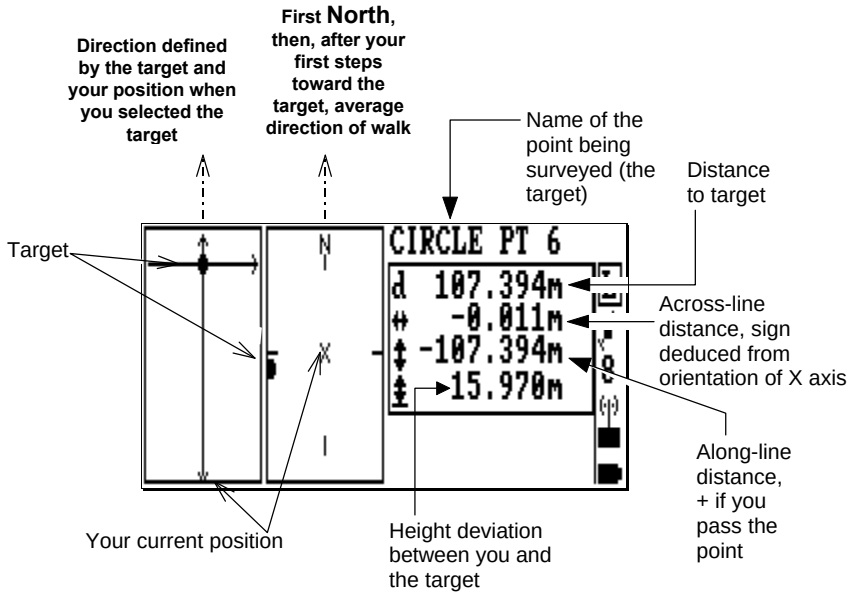
View 2D: Projects the locations of the points onto a plane (see page *4-61*). This view accurately shows the distribution of the points in the two-dimensional (XY) space.

Viewing the definition of the selected target point (press the **V** key then the **PgDn** key):



Directly from either of these screens, you can view the equivalent screen for the next, previous, top-of-list or end-of-list point by respectively pressing ↑, ↓, **Home** or **End**.

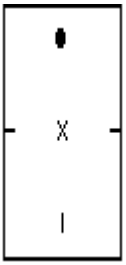
3. **Using the vertical-arrow keys, PgUp / PgDn or Home/End, move the cursor to a target point you want to go to and press** ↵. A new screen appears providing visual instructions to help you walk to this point.



- The leftmost chart will trace your walk to the target, starting from the position where you were (start position) when you selected that point. On this chart:
  - the target point is represented by a ✥ (immobile throughout the procedure)
  - Your position is represented by a X

- The vertical axis represents the direction defined by the target and *your* position *when you selected the target* (start position).
- The path you follow as you walk toward the target is represented by a dotted line starting from the start position:

- The other chart provides visual information about the direction to follow to reach the target. First the vertical axis represents the North direction. After you walk a few steps in the direction of the target, the vertical axis will then represent the average direction of walk:

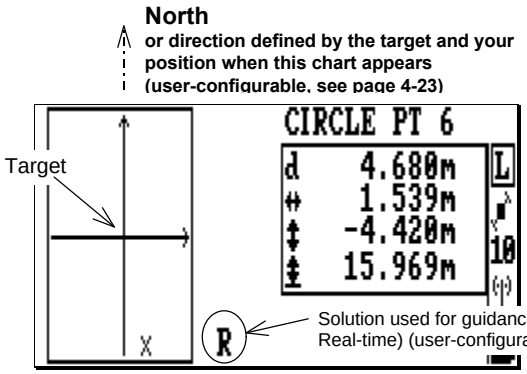


The same symbols as in the left-hand chart are used to represent the target and your current position. The distance between the two symbols is not representative of the true distance.

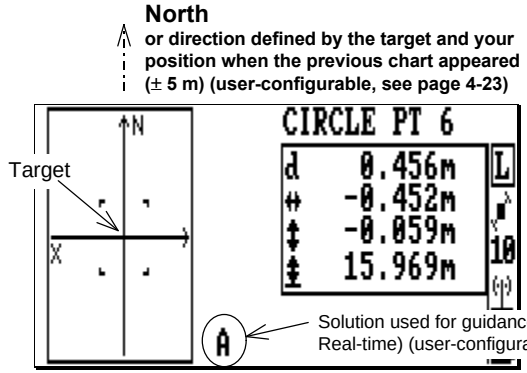
4. **Correct the direction of walk according to the indications on the screen; walk while continuing to read the screen for auto-correction of the path followed.**

If you realize that you cannot reach the target point, then press the **Esc** key to go back to the target points list screen and then press the **O** key. Then refer to page *4-26*, *Surveying target points through offset procedure*.

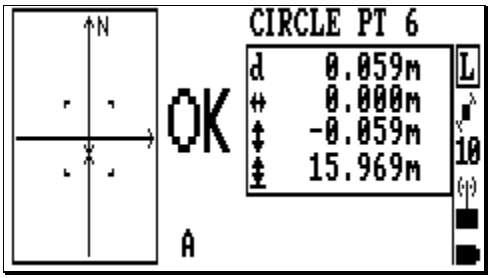
- When the distance to the target becomes less than 5 m, a new chart appears on the screen giving a magnified view of the area around the target point (± 5 m along each axis).



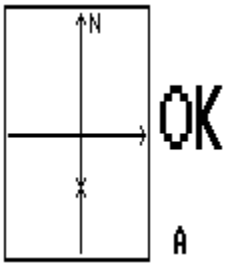
- When the distance to the target becomes less than 50 cm, the view is magnified a second time around the target point (± 0.5 m along each axis).



5. **Before surveying the point, you can refine the GPS antenna position so that the X accurately coincides with the origin of the axis system, taking care to maintain the antenna mast in vertical position**. As a result, the three components in the upper-right frame should be as close as possible to 0.000. The **OK** message will appear, suggesting that the point be recorded now, when the deviation between the target and your position is less than the acceptance circle defined for the job (see page *4-89*).

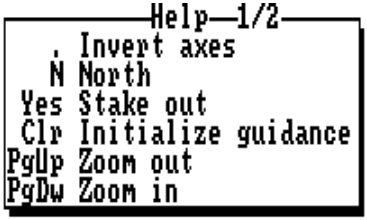


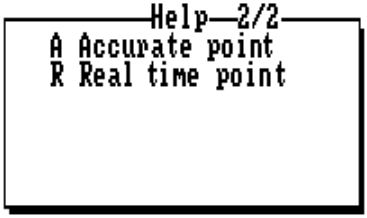
You can still zoom in around the target by pressing the **PgDn** key (± 0.15 m along each axis).



Associated **Help** menu during the guidance phase (2 screens):

(Displayed by pressing **F1**, removed by pressing **Esc**. Press **PgUp** or **PgDn** to change help menu)





Invert Axes: (On guidance chart)

North: Changes definition of vertical axis on ± 5 m, ± 0.5 m and ± 0.15 m charts

Stake Out: see *next page*.

Initialize Guidance: Deletes trace on left-hand chart

Zoom Out / Zoom In: Allows you to perform zoom-in/zoom-out operations on the guidance chart. Zooming-in is automatic from the initial view down to 0.50-m scale (intermediate scale: 5 m) as you approach the target. Switching to 0.15 m scale can only be manual by pressing the **PgDn** key. On the contrary, zooming-out is only obtained by pressing the **PgUp** key.

Accurate point: Chooses this solution to be used for guidance (accurate point computed every second)

Real time point: Chooses this solution to be used for guidance (solution available every 0.5 seconds, slightly noisier than the accurate point).

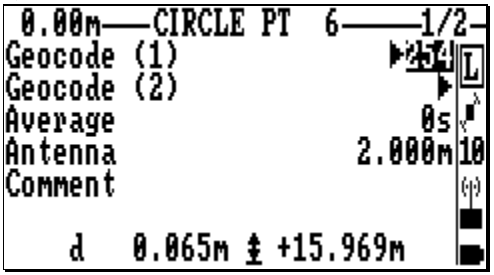
NOTE: The "Accurate" solution is always the only position solution logged, whatever the point you choose for guidance (Accurate or real-time)

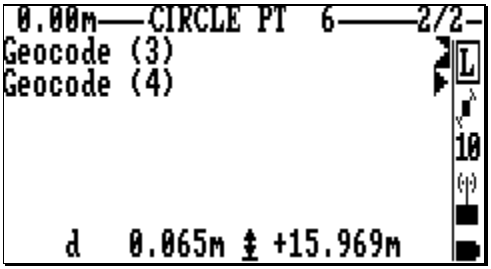
---

6. **Press the Yes key to access the log screen.** The following parameters can be changed if required:
   - Geocodes 1 & 2 (directly type a geocode in each field or choose a pre-defined one after pressing →)
   - Averaging time in seconds (**Average**). All the solutions acquired during this time will be averaged and only the solution resulting from this computation will be logged (enter "0" if you just wish to log the 1st position solution available)
   - GPS antenna height above ground
   - Comment

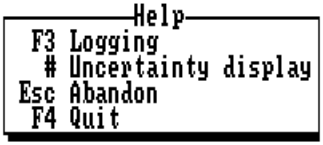
   Then after pressing **PgDn**
   - Geocodes 3 & 4 (directly type a geocode in each field or choose a pre-defined one after pressing →)

Uncertainty on position (see page 4-89)





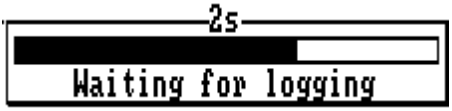
Associated **Help** menu:



(Displayed by pressing **F1**, removed by pressing **Esc**).

Logging: see 7 below
Uncertainty Display: see page *4-89*

7. **While still maintaining the GPS antenna mast in position, press the F3 key.** Stay immobile until the buzzer bleeps (waiting time depends on chosen averaging time). The following is displayed during this time (example):



The end of recording is denoted by the display of the target points list on the screen. Note that the point you have just surveyed is now marked with a letter corresponding to the processing mode used (“L” for “LRK”, etc.).

The next target point (see definition in page *4-63*) in the list is pre-selected to be the next point to be surveyed.

Surveying target points through offset procedure

If you know, or if you realize in the course of your walk to a target, that you cannot reach this target with the rover unit —because for example the reception conditions at this point could not allow the system to operate normally — then use one of the following two methods to survey this target: linear offset or lateral offset.

- **Linear Offset Principle**

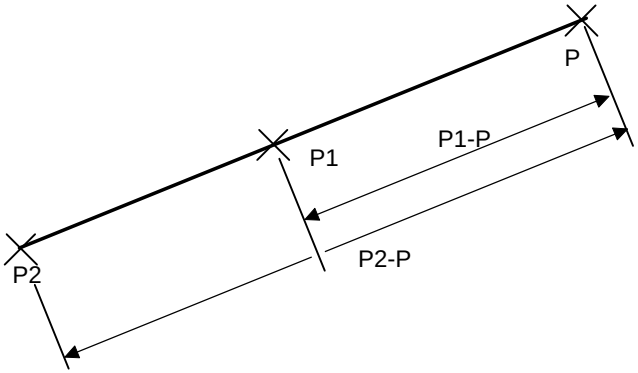
  Through this technique, the location of the inaccessible target point (P) will accurately be deduced from two points (P1 and P2) located nearby, properly logged, and both aligned with the target.

  First, the operator will freely choose and log the first point (P1), thus allowing the rover unit to define the direction of a line to P.

  Then the rover unit will guide the operator to the other point (P2) in order to align this point with the other two. The operator will then log P2.

  As a result, the rover unit will provide the distances separating P1 and P2 from the target.

  Finally, by way of external means (a simple meter for example), the operator will measure one of the distances from P1 and P2 (or the two) to the target to accurately locate this point.



- **Lateral Offset Principle**

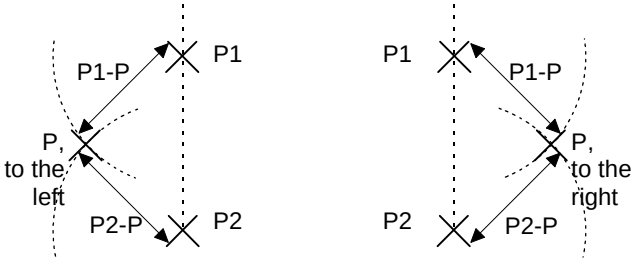
  Through this technique, the location of the inaccessible target (P) will accurately be deduced from two points (P1 and P2) located nearby, properly logged, and forming a triangle (ideally an equilateral one) with P.

  First, the operator will freely choose the first point (P1). The operator will log this point thus allowing the rover unit to provide the distance separating this point from P.

  Then, the operator will freely choose the other point (P2), keeping in mind that P1 and P2 should form a "regular" triangle with the presumed location of P. The operator will also log point P2 thus allowing the rover unit to provide the distance separating this point from P.

  As a result, the rover unit will also indicate the direction of P (to the right or to the left) in reference to the oriented segment P2P1.

  Finally, by way of external means (a simple meter for example), the operator will measure the distances from P1 and P2 to P, drawing two arcs of circles on the ground, the intersection of which (to the right or to the left of P2P1) will provide the exact location of P.

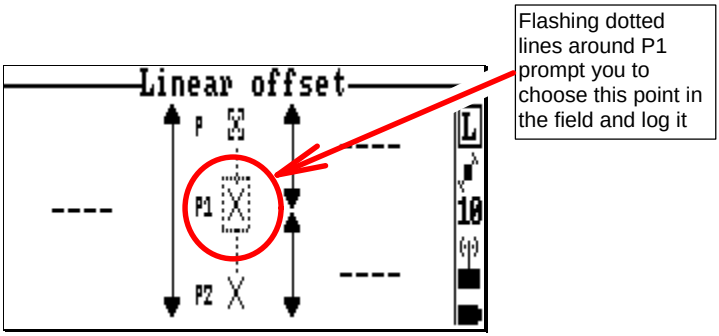


- **Linear Offset Procedure**

  Assuming you are in the vicinity of the inaccessible target, the palmtop screen displays the target points list of your job and the inaccessible target is selected in the list (see this context in page *4-16*), then do the following:

  1. **Press the O key**. In the menu which appears, select the linear offset type:

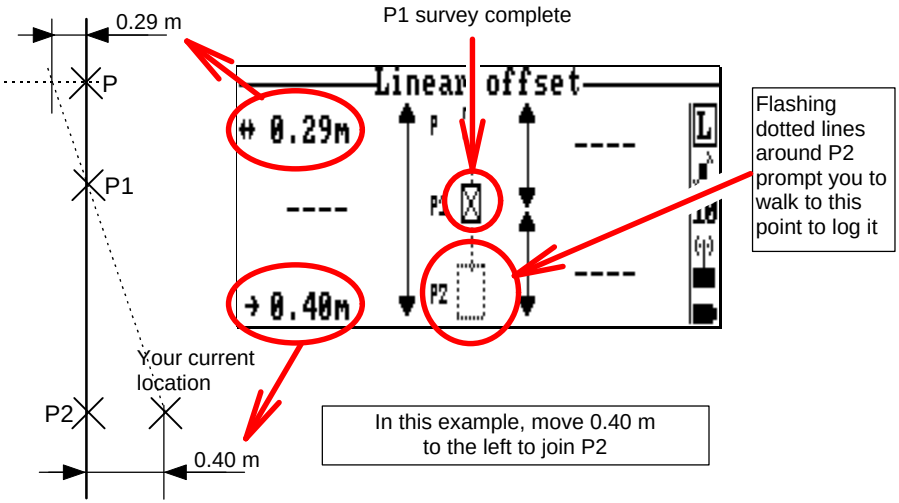
     A guidance screen then appears prompting you to freely choose P1 and to log this point:

  2. **Press the Yes key to access the log screen** (same log context as in Staking Out general case; see page *4-24*).

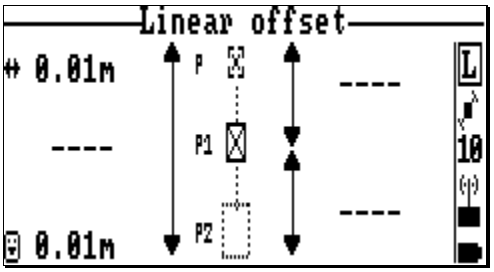
  3. **While maintaining the GPS antenna mast in position, press the F3 key.** Stay immobile until the buzzer bleeps (waiting time depends on chosen averaging time).

After P1 logging, the following screen appears prompting you to walk to P2:



4. **Walk to P2, observing the two indications provided in the left-hand part of the screen**. Remember the program just requests that P2 be aligned with P1 and P, which means that you can freely choose the distance separating P2 and P1.

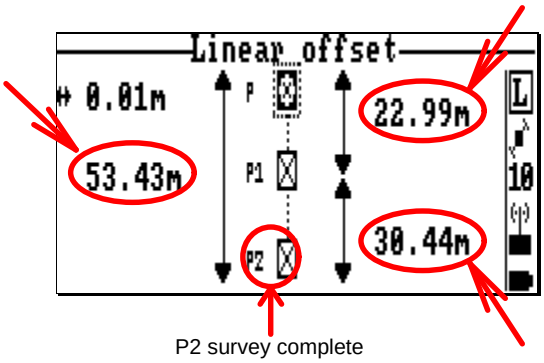
   Once P2 is aligned with the other points, the guidance screen will look like this:



5. **Press the Yes key to access the log screen** (same log context as in Staking Out general case; see page *4-24*).

6. **While maintaining the GPS antenna mast in position, press the F3 key.** Stay immobile until the buzzer bleeps (waiting time depends on chosen averaging time).

   After P2 logging the following screen appears providing the distances from P1 and P2 to the inaccessible target (P):



P2 survey complete

7. **Using the information now available on the palmtop screen, locate the inaccessible target with your own means.**

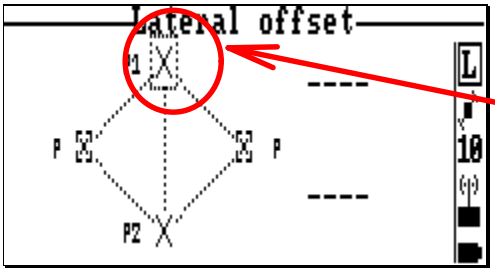
8. **Position the cursor on the P icon and, from any location, press the Yes key to store the P point as a point surveyed through offset procedure.**

- **Lateral Offset Procedure**

  Assuming you are in the vicinity of the inaccessible target, the palmtop screen displays the points list of your job and the inaccessible target is selected in the list (see this context in page *4-16*), then do the following:

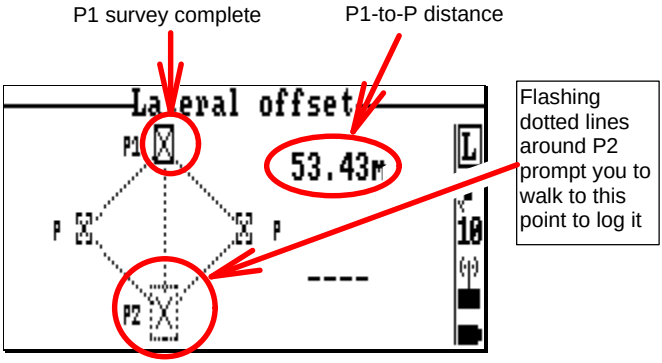
  1. **Press the O key**. In the menu which appears, select the lateral offset type:

A guidance screen then appears prompting you to freely choose P1 and to log this point:



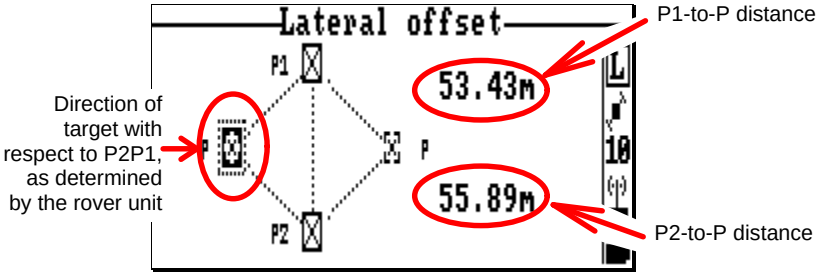
2. **Press the Yes key to access the log screen** (same log context as in Staking Out general case; see page *4-24*).
3. **While maintaining the GPS antenna mast in position, press the F3 key.** Stay immobile until the buzzer bleeps (waiting time depends on chosen averaging time).

   After P1 logging, the following screen appears prompting you to walk to P2:



4. **Choose an adequate location for P2** (i.e. so that the 3 points form a regular triangle).
5. **Press the Yes key to access the log screen** (same log context as in Staking Out general case; see page *4-24*).
6. **While maintaining the GPS antenna mast in position, press the F3 key.** Stay immobile until the buzzer bleeps (waiting time depends on chosen averaging time).

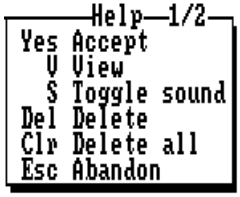
   After P2 logging the following screen appears providing the distances from P1 and P2 to the inaccessible target (P) and the direction of the target with respect to the oriented P2P1 segment:



7. **Using the information now available on the palmtop screen, locate the inaccessible target with your own means.**
8. **Position the cursor on the P icon and, from any location, press the Yes key to store the P point as a point surveyed through offset procedure.**

- **Associated Help menu during offset procedures**

The same **Help** menu is available when surveying a planned point through either of the available offset procedures:



(Displayed by pressing **F1**, removed by pressing **Esc**)

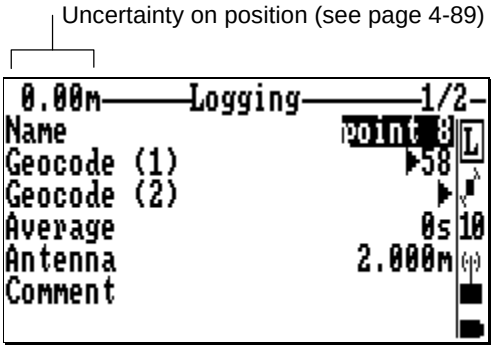
- Press the **Yes** key to access the log screen when you are ready to log the position of P1 or P2 or to log P.
- Press the **V** key to view the characteristics of the selected point on the guidance chart
- Press the **S** key if you want to enable or disable the palmtop buzzer (this command is available in linear offset only)
- Press the **Del** key if you want to delete the selected point (P1 or P2) and resume the logging of this point
- Press the **Clr** key if you want to resume the offset procedure from the beginning (P1 and P2 deleted).

Logging points

At any time during a job, you can log the position of any point. In what follows, it is assumed that a job and a file have been previously opened (see page *4-11*).

General case

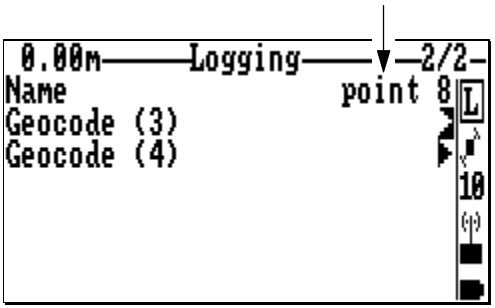
1. **Come back to the main menu, select** **and then choose Logging (2)**. The log screen appears.



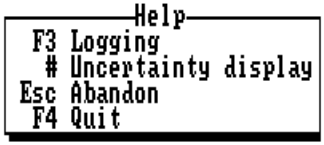
2. **Change some of the parameters on this screen if necessary:**
   - Name of logged point (default: point #)
   - Geocodes 1 & 2 (directly type a geocode in each field or choose a pre-defined one after pressing →)
   - Averaging time in seconds (**Average**). All the solutions acquired during this time will be averaged and only the solution resulting from this computation will be logged (enter "0" if you just wish to log the 1st position solution available)
   - GPS antenna height above ground
   - Comment

After pressing **PgDn**, you can also change Geocodes 3 & 4 (directly type a geocode in each field or choose a pre-defined one after pressing →).

Name you have just defined for the logged point



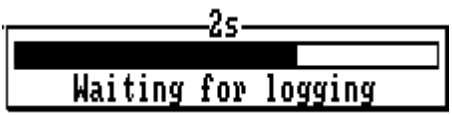
Associated **Help** menu:



(Displayed by pressing **F1**, removed by pressing **Esc**).

Logging: see **3** below
Uncertainty Display: see page *4-89*

3. **While maintaining the GPS antenna mast in position, press the F3 key.** Stay immobile until the buzzer bleeps (waiting time depends on chosen averaging time). The following is displayed during this time (example):



The end of recording is denoted by the display of the default characteristics for the next point to be logged.

Logging points through offset procedure

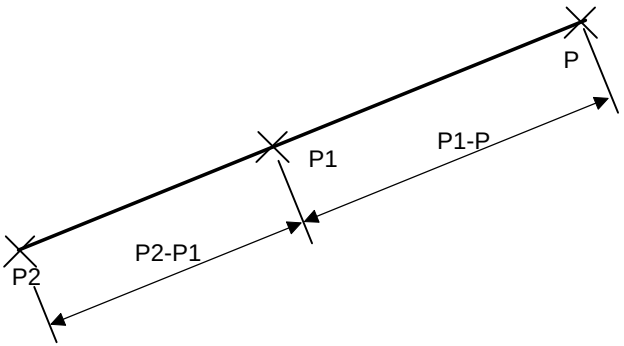
For the same reasons as in staking out (see page *4-26*), you may have to resort to an offset procedure to log the position of an inaccessible point. Three different methods exist in this case to log a non-planned point: linear, lateral and intersection.

- **Linear Offset Principle**

  Through this technique, the location of the inaccessible point (P) will accurately be deduced from two points (P1 and P2) located nearby, properly logged, and both aligned with the point.

  First, the operator will freely choose two points in the field (P1 and P2) aligned with point P.

  After measuring —with other means— one of the distances separating P1 or P2 from P, the operator will enter this distance in the corresponding field, from which the rover unit will deduce the position of P.

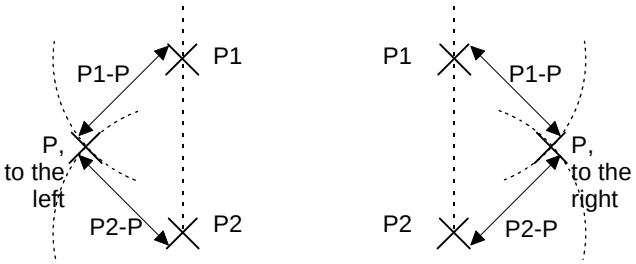


- **Lateral Offset Principle**

  Through this technique, the location of the inaccessible point (P) will accurately be deduced from two points (P1 and P2) located nearby, properly logged, and forming a triangle (ideally an equilateral one) with P.

  First, the operator will freely choose two points in the field (P1 and P2) forming a "regular" triangle with P.

After measuring —with other means— the distances separating P1 and P2 from P, the operator will enter successively each of these distances when logging these points. The direction of P with respect to the oriented segment P2P1 will also have to be specified.

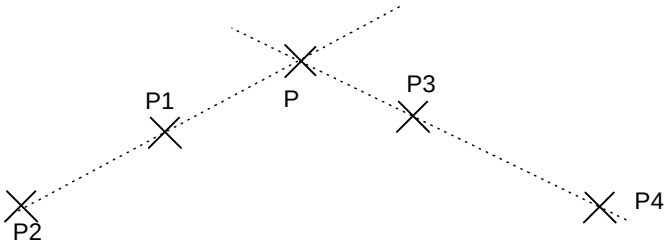


- **Intersection offset principle**

Through this technique, the location of the inaccessible point (P) will accurately be deduced from two pairs of points (P1,P2) and (P3,P4) defining two lines intersecting at point P.

First, the operator will freely choose the two pairs of points in the field so that the engendered lines intersect at P .

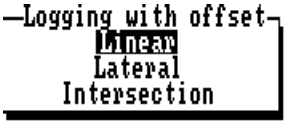
Then the operator will successively log the 4 points P1, P2, P3 and P4. The interest of this method lies on the fact that the operator does not need to measure anything in the field, apart from making sure that first, P1 and P2 are aligned with P, and second, that P3 and P4 are also aligned with P.



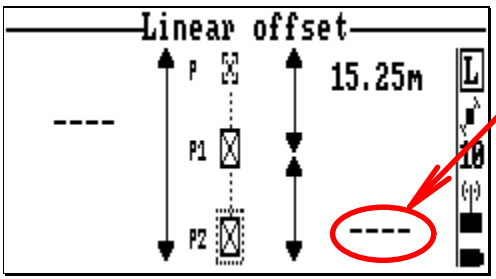
- **Linear Offset Procedure**

  In what follows, it is assumed that a job and a file have been previously opened (see page *4-11*). After marking P1 and P2 in the field and after measuring the P1-to-P distance for example, do the following:

  1. Come back to the main menu, select , choose **Logging with offset** (5) and then select **Linear**:

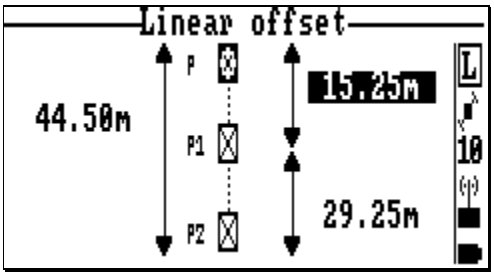
  2. Walk to P1 and stay immobile at this point
  3. Press the **Yes** key to access the log screen (same log context as in Logging general case; see page *4-34*).
  4. While maintaining the GPS antenna mast in position, press the **F3** key. Stay immobile until the buzzer bleeps (waiting time depends on chosen averaging time).
  5. After P1 logging, select the P1P distance field (upper - right) and enter this distance (e.g. 15.25 m). The screen now looks like this:

     Can only be completed by the system

6. Walk to P2. Choose it to be aligned with P1 and P. Stay immobile at this point.
7. Press the **Yes** key to access the log screen (same log context as in Logging general case; see page *4-34*).
8. While maintaining the GPS antenna mast in position, press the **F3** key. Stay immobile until the buzzer bleeps (waiting time depends on chosen averaging time).

   After P2 logging, the rover unit computes the other distances represented on the screen. For example, at the end of the procedure, your screen looks like this:

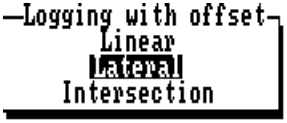


9. **Position the cursor on the P icon and, from any location, press the Yes key to store the P point as a point surveyed through offset procedure.**

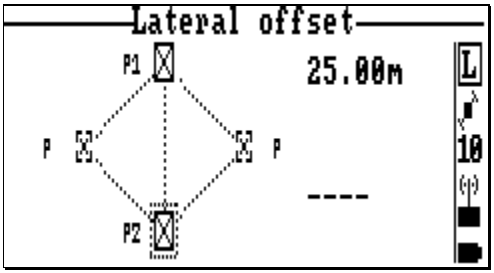
- **Lateral Offset Procedure**

In what follows, it is assumed that a job and a file have been previously opened (see page *4-11*). After marking P1 and P2 in the field and after measuring the two distances to P, do the following:

1. Come back to the main menu, select , choose **Logging with offset** (6) and then select **Lateral**:

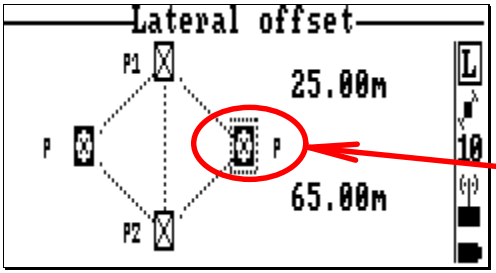


2. Walk to P1 and stay immobile at this point
3. Press the **Yes** key to access the log screen (same log context as in Logging general case; see page *4-34*).
4. While maintaining the GPS antenna mast in position, press the **F3** key. Stay immobile until the buzzer bleeps (waiting time depends on chosen averaging time).
5. After P1 logging, select the P1P distance field (upper-right) and enter this distance (e.g. 25.00 m). The screen should now look like this:



6. Walk to P2 and stay immobile at this point
7. Press the **Yes** key to access the log screen (same log context as in Logging general case; see page *4-34*).
8. While maintaining the GPS antenna mast in position, press the **F3** key. Stay immobile until the buzzer bleeps (waiting time depends on chosen averaging time).
9. After P2 logging, select the P2P distance field (lower-right) and enter this distance (e.g. 65.00 m).

10. Specify the location of P with respect to the oriented segment P2P1. Once the cursor is located at the right point, press the **Yes** key to confirm this location and store this point as a point surveyed through offset procedure. The screen should now look like this:



Point to the right of P2P1

NOTE: You can use P1 and P2 as many times as necessary to log other inaccessible points (in the vicinity of P1 and P2).

4

- **Intersection Offset Procedure**

In what follows, it is assumed that a job and a file have been previously opened (see page *4-11*). After marking P1 to P4 in the field, do the following:

1. Come back to the main menu, select , choose **Logging with offset** (6) and then select **Intersection**:

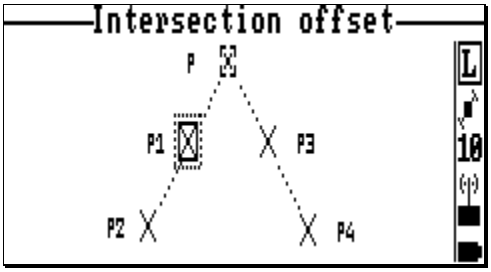
2. Walk to P1 and stay immobile at this point

3. Press the **Yes** key to access the log screen (same log context as in Logging general case; see page *4-34*).

4. While maintaining the GPS antenna mast in position, press the **F3** key. Stay immobile until the buzzer bleeps (waiting time depends on chosen averaging time).

5. Repeat step 2 to step 4 successively for points P2, P3 and P4

   Once all the points have been successfully logged, the screen should look like this:



6. Position the cursor on the P icon and, from any location, press the **Yes** key to store P as a point surveyed through offset procedure.

- **Associated Help menu during offset procedures**

The same **Help** menu is available when surveying a non-planned point through either of the available offset procedures:

(Displayed by pressing **F1**, removed by pressing **Esc**)

- Press the **Yes** key to access the log screen when you are ready to log the position of P1, P2, P3, P4 or P
- Press the **V** key to view the characteristics of the selected point on the guidance chart
- Press the **Del** key if you want to delete the selected point (P1, P2 P3 or P4) and resume the logging of this point
- Press the **Clr** key if you want to resume the offset procedure from the beginning (all points deleted)

Surveying a trajectory

There are two ways of surveying a trajectory:

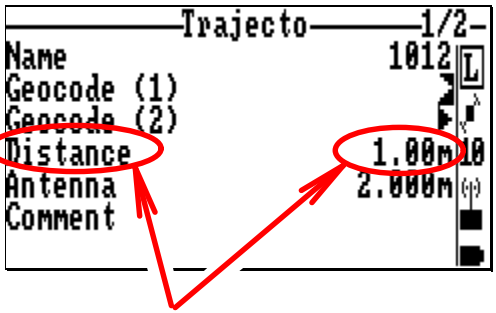
- Surveying in Distance mode: as you walk along the trajectory, the rover unit logs your current position every x meters traveled until you stop working in this mode.
- Surveying in Time mode: as you walk along the trajectory, the rover unit logs your current position every x seconds until you stop working in this mode.

In both cases and at any time during the survey of the trajectory, you are allowed to perform the logging of a point. This point will also be part of the series of points making up the trajectory.

Because the two procedures are very similar, we will only describe one of them (distance mode) and we will annotate the parameters which are different when the other mode is used.

1. **Come back to the main menu, select** **and choose Trajecto (4).** The following dialog box appears:

2. **Choose the Distance mode**. The screen should then look like this:



Or Time, in seconds, if surveying in Time mode has been selected

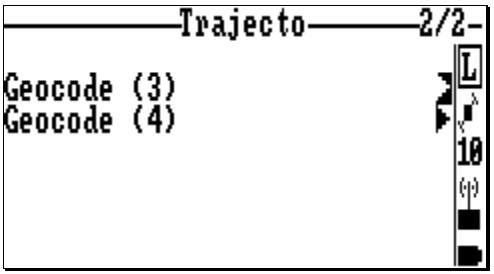
3. **Change some of the parameters on this screen if necessary:**

   - Name of start point
   - Geocodes 1 & 2
   - **Distance**: value of distance, in meters, causing a new point to be logged whenever this distance has been traveled by the field operator

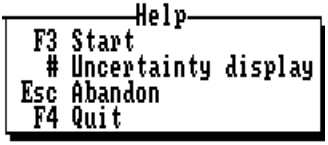
     or, in Time mode:

     Time: value of time, in seconds, causing a new point to be logged whenever this time has elapsed
   - GPS antenna height above ground
   - Comment

   After pressing **PgDn**, you can also change Geocodes 3 & 4.



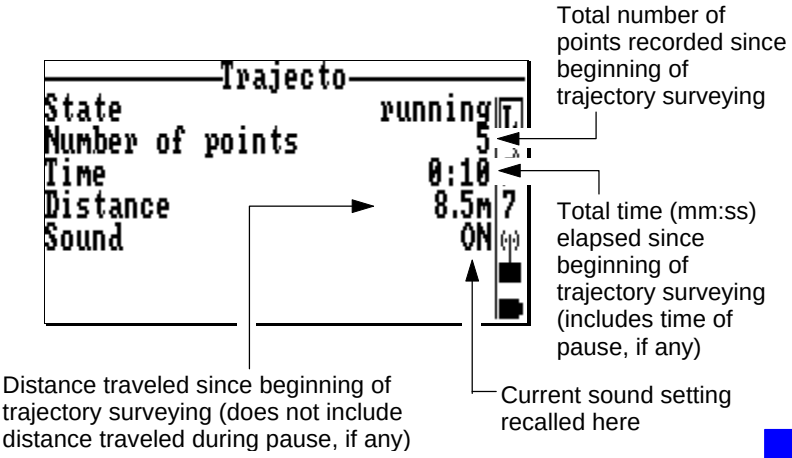
Associated **Help** menu before starting surveying the trajectory:



(Displayed by pressing **F1**, removed by pressing **Esc**)

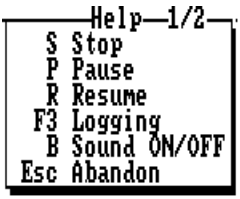
- **Start**: see below
- **Uncertainty display**: see page *4-89*

4. **Press the F3 key to start surveying the trajectory**. The screen should now look like this:



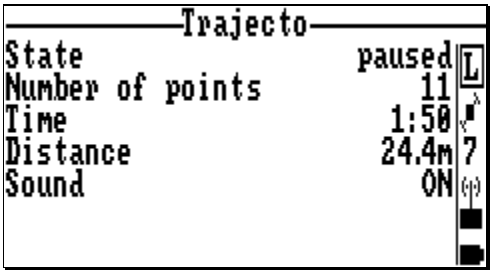
Associated **Help** menu while surveying a trajectory:

(Displayed by pressing **F1**, removed by pressing **Esc**)



- Press the **S** key to definitively stop the trajectory surveying
- Press the **P** key to suspend the surveying of the trajectory
- After pressing the **P** key for a pause, press the **R** key to continue the surveying of the trajectory
- Press the **F3** key to log an additional point. This point will be part of the trajectory. When selecting this function, proceed as explained in page *4-34* or *4-36*.
- Press the **B** key to toggle the sound setting (on or off)

Screen obtained with trajectory surveying paused (in distance mode):



Surveying reference points

Assuming a job and a file are open:

- From the main menu, select and then **Reference point** (3). The screen shows the list of reference points prepared for the selected job.
- Select a reference point and then proceed as if it were a target point (refer to this procedure described from page *4-16*).

NOTE: If your intention is to survey reference points to determine or refine the coordinate system used, this procedure should be run from a different context (please refer to page *4-51*).

Guidance along a profile

This function provides the operator with guidance instructions to help him/her walk along a *profile*. In fact, a *profile* is a series of points which the operator has previously chosen and placed in a given order. The straight line connecting any two consecutive points that are part of the *profile* is called *segment.*

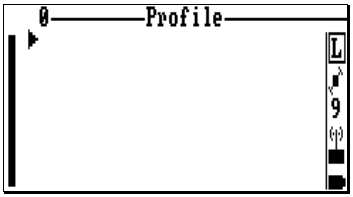
From the screen providing guidance, the following operations can be performed:

- Logging any point
- Logging a trajectory in distance or time mode
- Manual selection of the next or previous segment.

NOTE: You cannot create a profile with KISS. Instead, you can anticipate the creation of a profile by creating the corresponding points with appropriate names (i.e. producing the list of points in the desired order when sorting these points into alphabetical order) and by allocating the same geocode to all these points. Then, on the palmtop, you will be able to quickly retrieve these points through the search command —by specifying the appropriate geocode criterion— so that you can use the resulting list of points directly as a profile.

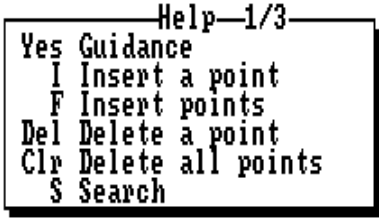
Assuming a *job* and a *file* are open:

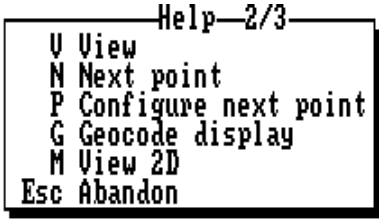
1. From the main menu, select then **Profile** (6). If no profile has been defined yet for the job, then the screen shows an empty list:



Associated **Help** menu (3 screens):

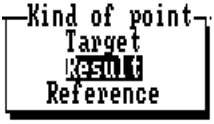
(Displayed by pressing **F1**, removed by pressing **Esc**. Press **PgUp** or **PgDn** to change help menu)





Guidance: see page *4-50*
Insert a point: See next page
Insert points: See next page
Delete a point: Press the **Del** key to remove the selected point from the profile
Delete all points: Press the **Clr** to remove all the points currently making up the profile
Search: Press the **S** key to search for a new point (to be continued in page *4-64*)
View: Press the **V** key to view the definition of the selected point
Next point: Press the **N** key to select the point you defined as the "next point" (see below)
Configure next point: Press the **P** key to define the nature of the next point (to be continued in page *4-63*)
Geocode display: Allows you to choose which geocode (1, 2, 3 or 4) should be displayed in the list of points
View 2D: Projects the locations of the points onto a plane (see page *4-69*). This view accurately shows the distribution of the points in the two-dimensional (XY) space.

2. Press the **F** key (or the **I** key for a point-by-point selection) to create the list of points forming the profile. The following dialog box displays:



3. After making a selection, press the **Yes** key. If you pressed the **F** key, another dialog box appears asking you to specify the type of selection you want to do:

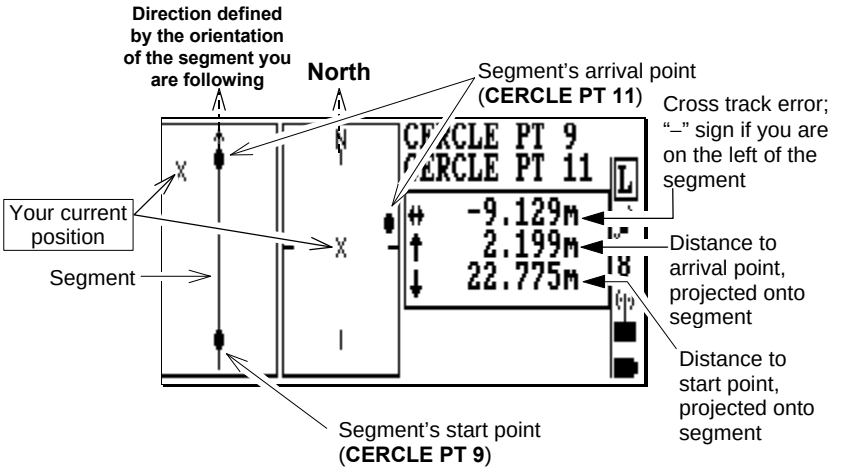
All: you want to select all the points from the selected list

P1...P2: you want to select all the points between two points which you have then to specify (these two points will also be part of the selection)

By name: you want to select all points whose names include a string that you must specify (use * if necessary)

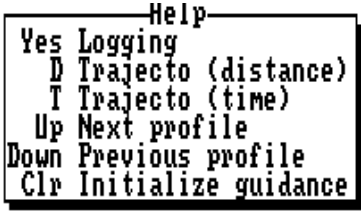
By geocode: you want to select all points whose geocodes include a string that you must specify (use the wild card symbol “*” if necessary).

4. Once the profile has been defined, press the **Yes** key to let the system compute and display guidance instructions helping you walk along each segment of the profile. Example of screen then obtained:



Associated **Help** menu:

(Displayed by pressing **F1**, removed by pressing **Esc**)



Logging: see page 4-34
Trajecto (distance): See page 4-43
Trajecto (time): See page 4-43
Next profile: Press the **Up** key to display the next segment (on leftmost diagram)
Previous profile: Press the **Down** key to display the previous segment (on leftmost diagram)
Initialize guidance: Press the **Clr** key to delete the trace of the path you have followed since the previous initialization (on leftmost diagram).

5. Now that guidance instructions are provided on the screen, proceed with the job as such.

Refining the coordinate system by surveying reference points

When the work area includes reference points whose locations are accurately known in the coordinate system you have to use, and on the other hand some of the characteristics of this coordinate system are not precisely known, then you can rely on the surveying of these points to refine the definition of the coordinate system.

This kind of computation can be performed either by the rover unit or, when back at the office, by the KISS module of 3SPack. Refer to the *3SPack Reference Manual* or to the *On-Line Help file* of the KISS module for more information about geodetic choice issues.

When surveying a point, basically the rover unit computes the coordinates of this point on the WGS84. Then computations are run to transform these WGS84 coordinates into coordinates expressed on the chosen datum and projection.

If we assume that both the "theoretical" coordinates of a reference point expressed in the partially unknown system and the surveyed WGS84 coordinates for the same point are error-free, then the rover unit can refine the coordinate system used so that the "theoretical" coordinates of the point be precisely the coordinates obtained by transforming the surveyed WGS84 coordinates using the refined coordinate system.

Two kinds of computation can be performed in the rover unit:

- refining the horizontal system (local grid)
- or/and refining the vertical system (height correction)

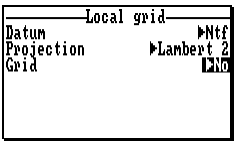
When preparing a job with KISS, if reference points are created for the purpose of refining the coordinate system used, then follow the instructions below to refine the coordinate system.

Note that a third type of computation is possible using reference points surveyed by the rover unit. The purpose of this computation, which can only be performed with KISS when back at the office, is to refine the datum shifts of the system used (if it is a standard one).

Refining the horizontal system (local grid)

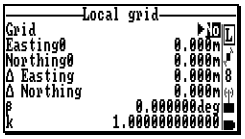
- **Phase 1: surveying the known reference points**

1. From the main menu, select and then **Local grid** (4). On the screen which then appears, position the pointer on the **Grid** field:

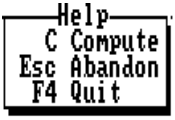


2. Press → to access the **Local Grid** screen.

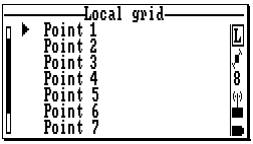
   Unless already done, select **No** in this field (compulsory):



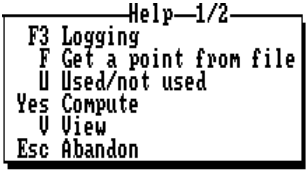
   Help menu associated with this screen:



3. Press the **C** key (**Compute**). The screen now shows a list of "blank" reference points (see opposite). You have first to transfer "true" reference points to this list. For example if 3 reference points have been created in the job for the purpose of refining the coordinate system, you should now transfer these 3 points to the above list (to appear as the first 3 points in the list for example).



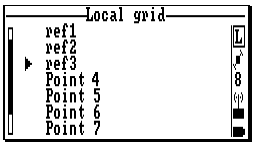
   Associated **Help** menu:



4. In the list, select **Point 1** and then press the **F** key (**Get a point from file**). The list of reference points defined for the job now appears on the screen

5. Select one of the reference points you wish to use to refine the coordinate system and then press the **Yes** key.

6. Repeat steps **4** and **5** until all the useful reference points are transferred. The screen now should look like this:



7. Select the first reference point in the list (ref 1), walk to this point and when arrived at this point, log its position by pressing the **F3** key (same procedure as if you were logging a point; see page *4-34*). After logging this point, the palmtop comes back to the list of reference points.

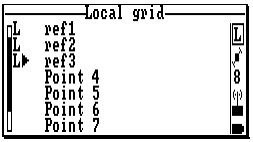
NOTES: The point name is now preceded by a letter indicating the valid processing mode when the point was logged (example: "**L**").

In this particular context, there cannot be any guidance screen to help you reach the reference point as this would require a thoroughly defined coordinate system, which is precisely not the case.

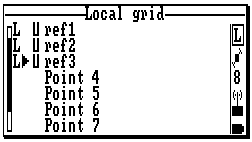
If these reference points have been previously surveyed to refine the height correction, then you do not need to resume this operation. In this case, you can skip steps **3** to **8**.

---

8. Repeat step **7** until all the reference points are logged:

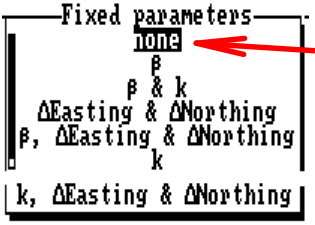


9. To involve each of the surveyed reference points into the local grid computation, successively select each of them and press the **U** key (see associated **Help** menu). Finally the screen should look like this:



- **Phase 2: computing the local grid**

10. Press the **Yes** key to start computing the local grid. First, you must specify whether some parameters of the local grid should be fixed. Highlight the desired option and press the **Yes** key (a single selection possible):



Usual choice: **None**

If you elect to fix some parameters, then they will be fixed to their current values.

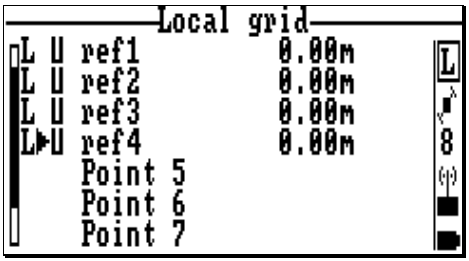
Then, the program asks you whether you want to fix the origin of the grid or not:

Usual choice: **Not fixed**

- **Not fixed**: The barycenter of the selected points will be used as the origin of the local grid.
- **Fixed**: The values of Easting0 and Northing0 coordinates displayed when accessing the **Local Grid** screen (see step **2**) are chosen to be the origin of the local grid.

At the end of the computation the deviations between the theoretical locations of the reference points and the coordinates obtained by projecting the surveyed WGS84 coordinates onto the computed local grid are provided opposite the point names.

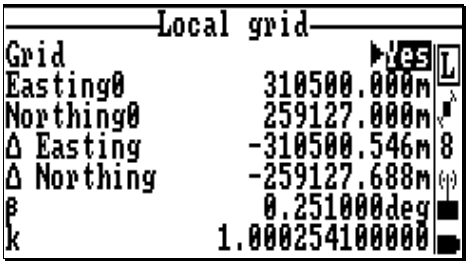
The closer to 0.00 these deviations, the better the computed local grid:



- **Phase 3: validating the new local grid**

11. Press the **Esc** key to come back to the screen displaying the characteristics of the grid

12. Position the cursor in the **Grid** field and select **Yes**. This validates the new local grid. Screen example:



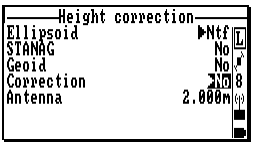
End of procedure.

4

Computing the vertical system (height correction)

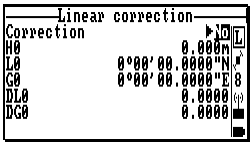
- **Phase 1: surveying the known reference points**

1. From the main menu, select and then **Height correction** (5). On the screen which then appears, position the pointer on the **Correction** field:

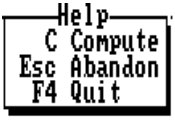


2. Press → to access the **Linear correction** screen.

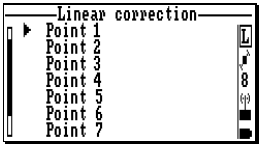
   Unless already done, select **No** in this field (compulsory):



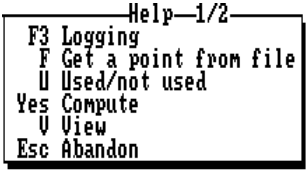
   Help menu associated with this screen:



3. Press the **C** key (**Compute**). The screen now shows a list of "blank" reference points (see opposite). You have first to transfer "true" reference points to this list. For example if 3 reference points have been created in the job for the purpose of refining the coordinate system, you should now transfer these 3 points to the above list (to appear as the first 3 points in the list for example).



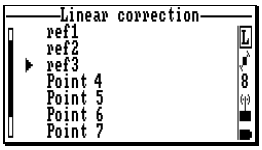
   Associated **Help** menu:



4. In the list, select **Point 1** and then press the **F** key (**Get a point from file**). The list of reference points defined for the job now appears on the screen

5. Select one of the reference points you wish to use to refine the coordinate system and then press the **Yes** key.

6. Repeat steps **4** and **5** until all the useful reference points are transferred. The screen now should look like this:



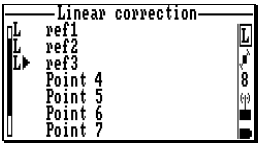
7. Select the first reference point in the list (ref 1), walk to this point and when arrived at this point, log its position by pressing the **F3** key (same procedure as if you were logging a point; see page *4-34*). After logging this point, the palmtop comes back to the list of reference points.

NOTES: The point name is now preceded by a letter indicating the valid processing mode when the point was logged (example: "**L**").

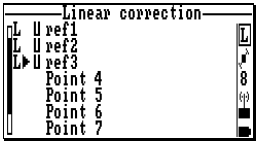
If these reference points have been previously surveyed to refine the local grid, then you do not need to resume this operation. In this case, you can skip steps 3 to 8.

---

8. Repeat step **7** until all the reference points are logged:



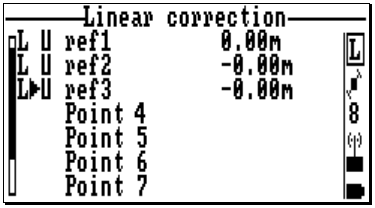
9. To involve each of the surveyed reference points into the height correction computation, successively select each of them and press the **U** key (see associated **Help** menu). Finally the screen should look like this:



- **Phase 2: computing the vertical system**

10. Press the **Yes** key to start computing the height correction.

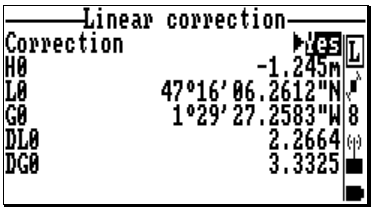
    At the end of the computation, the deviations between the theoretical heights of the reference points and those obtained with the computed vertical system are provided opposite the point names. The closer to 0.00 these deviations, the better the computed vertical system:



- **Phase 3: validating the new vertical system**

11. Press the **Esc** key to come back to the screen displaying the characteristics of the vertical system.

12. Position the cursor in the **Correction** field and select **Yes**. This validates the new vertical system. Screen example:

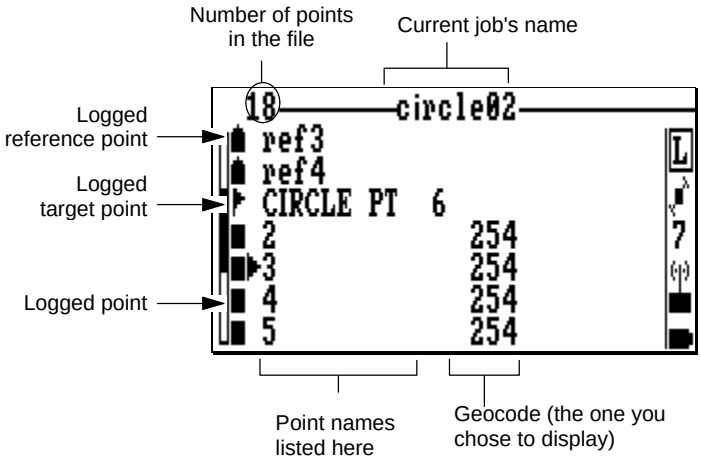


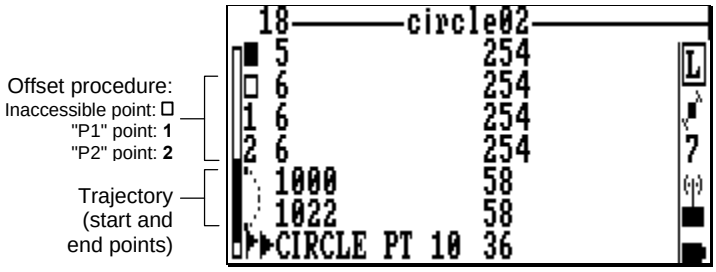
End of procedure.

Ancillary procedures

Working on the results of the job

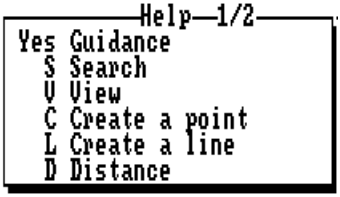
- Come back to the main menu, select and then **Result point** (3). A new screen now appears showing the list of surveyed points. Small icons are used to help you identify the type of each point surveyed. Screen examples :

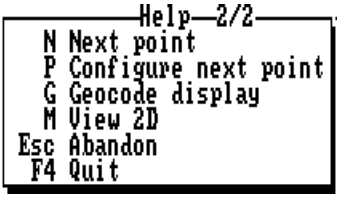




Associated **Help** menu (2 screens):

(Displayed by pressing **F1**, removed by pressing **Esc**. Press **PgUp** or **PgDn** to change help menu)





Guidance: see page *4-19*

Search: Press the **S** key to search for a new point (to be continued in page *4-64*)

View: Press the **V** key to view the definition of the selected point (see the 2 screens in the bottom of this page)

Create a point: Press the **C** key to create a new point (to be continued in page *4-64*)

Create a line: Press the **L** key to create a new line (to be continued in page *4-66*)

Distance: Press the **D** key to access the screen allowing you to measure the distance between any two points (see page *4-61*)

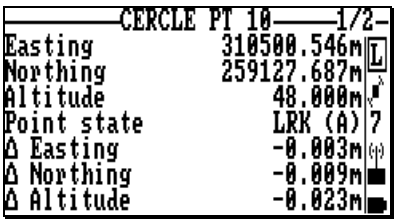
Next point: Press the **N** key to select the point you have defined as the "next point" (see below)

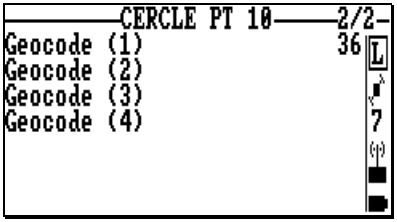
Configure next point: Press the **P** key to define the nature of the next point (to be continued in page *4-63*)

Geocode display: Allows you to choose which geocode (1, 2, 3 or 4) should be displayed in the list of points

View 2D: Projects the locations of the points onto a plane (see page *4-69*). This view accurately shows the distribution of the points in the two-dimensional (XY) space.

Viewing the results of the selected point (press the **V** key then the **PgDn** key):





Directly from either of these screens, you can view the equivalent screen for the next, previous, top-of-list or end-of-list point by respectively pressing ↑, ↓, **Home** or **End**.

Measuring the distance between any two points

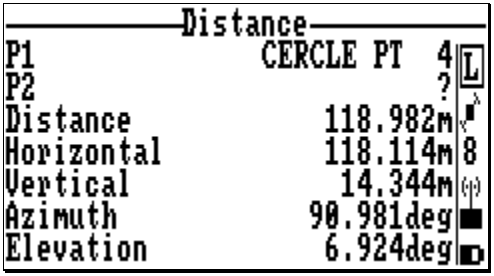
(Continued from page *4-17* or *4-60*)

This function allows you to know the distance between any two points. Once you have selected the two points, the following parameters are determined:

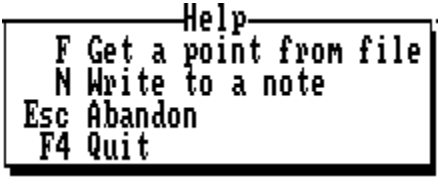
- Modulus, horizontal and vertical components of the distance (and the resulting elevation angle)
- Azimuth angle of the straight line connecting the selected two points.

Procedure:

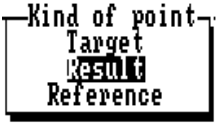
1. Before running this function, from the points list, select the first of the points involved in the measurement (in the example below, this point is named “CERCLE PT 4”)
2. Then press the **D** key. The screen which then appears shows the name of the point you have just selected (P1). Until the second point is selected, the results displayed on that screen are those computed for the distance separating your *current position* from the selected P1 point.



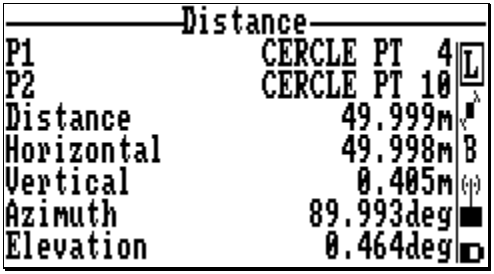
Help menu associated with the previous screen:
(Displayed by pressing **F1**, removed by pressing **Esc**)



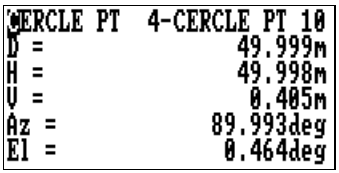
3. Press the **F** key to be able to select the second point (P2). Specify the type of this point…:



…and then choose it from the list which then displays (CERCLE PT 10 in the example below). Now that the 2nd point is selected, the results displayed on the screen are those for the distance separating P2 from P1:



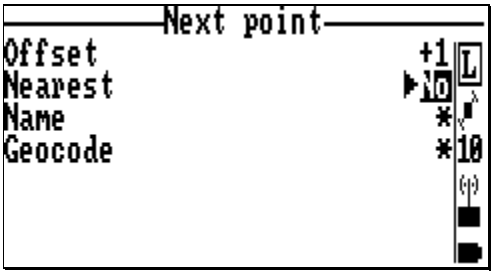
4. If needed, you can write these results into the notepad by simply pressing the **N** key. The data transferred to the notepad, and corresponding to the previous screen, would be formatted as follows in the notepad:



Configuring the "next point"

(Continued from page *4-17* or *4-60*)

In the context described in either of these pages, the following screen will be obtained after you press the **P** key. Then whenever you press the **N** key in the same context, the program will automatically refer to the criterion you specified in the screen below to select the "next point":



As shown on this screen, you can choose one of the following 4 criteria:

- Offset (or Line Increment):
  - +1⇒ selects point in next line
  - –1⇒ selects point in preceding line, etc.
- Nearest (Yes/No)
- By name (12 characters max.; you can use one or two "*", one at the beginning, one at the end; this symbol can replace one or more characters in a name)
- By geocode (12 characters max.; you can use one or two "*", one at the beginning, one at the end; this symbol can replace one or more characters in a geocode).

You can combine several criteria. You cannot however combine the **Nearest** criterion with the **Offset** criterion.

"Search" function

(Continued from page *4-17* or *4-60*)

In the context described in either of these pages, the following screen will appear after you press the **S** key.

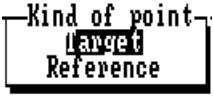
- Select the desired option
- If you select **by name** or **by geocode**, a new dialog box will appear asking you to specify the search criterion

The **Search** and **Next Point** functions are much similar (same purpose, nearly the same criteria). The main difference is that with the **Search** function, you will have to specify a criterion every time you run this function, which is not the case with the **Next Point** function. Another difference is that criteria combination is possible with **Next Point**, not with **Search**.

Creating a point

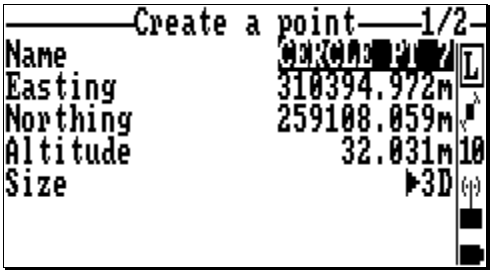
(Continued from page *4-17* or *4-60*)

In the context described in either of these pages, the following screen will appear after you press the **C** key:

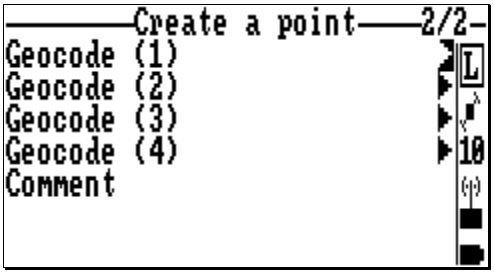


- Select the type of point you wish to create and press the **Yes** key. The screen which then appears allows you to enter the characteristics of the new point (default values: those of the point selected in the list).

- Make the necessary changes. Example:



- Then press **PgDn** and make the necessary changes. Example:



- When the definition is complete, and as suggested by the associated **Help** menu...

... press the **F3** key to store the new point.

4

Creating a line

(Continued from page *4-17* or *4-60*)

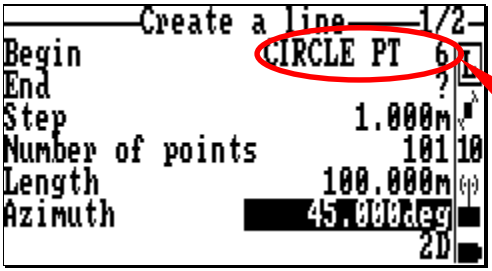
The notion of *line* is just used in the rover unit to create a series of *aligned* points.

There are two ways of creating a line:

- either you define the start point, the azimuth of the line and any 2 of the following 3 parameters:
  - number of points in the line
  - basic distance between any two consecutive points
  - total length of the line
- or you simply define the start point, the end point and the number of points along the line (or the basic distance between any two consecutive points). The end point can be the location of a target point, a reference point or a result point.

In both cases, the start location of the line is necessarily that provided by the currently selected point.

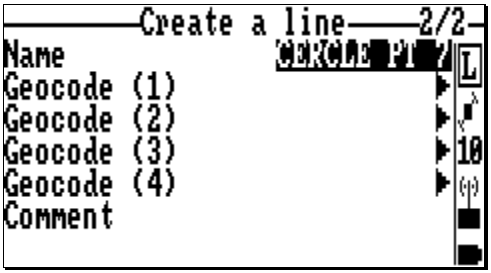
In the context described in page *4-17* or *4-60*, the following screen type will appear after you press the **L** key:



Name of selected point. This point provides the location of the beginning of the line

- On this screen, enter the parameters defining the line. If you want to define the end of the line with a point, then you don't need to enter an azimuth angle.

- Then press the **PgDn** key. On the new screen which then appears, enter a name for the start point of the line and the possible associated geocodes. Screen example:



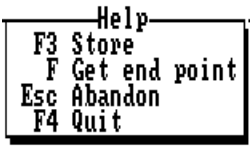
Preferably choose a name for the start point so that a numerical string is included at the end of this name (e.g. tarpt001).

In fact when you store the line (i.e. you let the program create the aligned target points), automatic point naming is performed on the basis of the start point's name, the program then incrementing by 1 the numerical string as it creates the points (if there is no numerical string, then the name suffix will be in the form ~1, ~2, etc.).

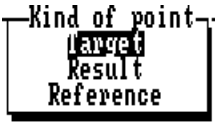
4

Help menu associated with the above two screens

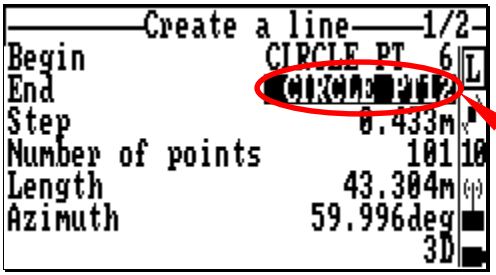
(Displayed by pressing **F1**, removed by pressing **Esc**)



- If you want to define the end of the line by specifying a particular point, then press the **F** key (**Get end point**). In the dialog box which then appears, select the kind of point you want to use:



- Then press **Yes**. The list of points corresponding to the chosen type of point appears on the screen
- Choose the desired point and press **Yes**. The screen should now look like this:

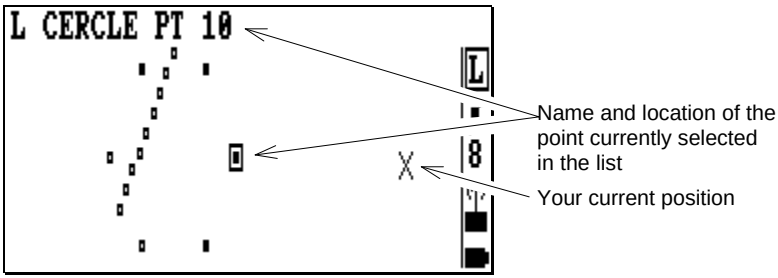


Name of chosen point. This point provides the location of the end of the line

- Finally press **F3** to store the line. As a result, a series of points is created according to the definition of this line.

Viewing points on a plane (2D view)

Within the context of page *4-17* or *4-60*, pressing the **M** key causes a view to appear showing the points projected onto a plane (hence a 2-D view is obtained). This view depicts the geometrical distribution of the points in the working area. View example:

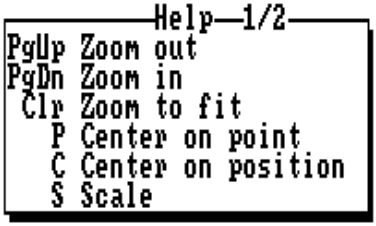


Conventions used:

- Location of the point currently selected in the list
- Logged or staked-out point
- Point still to log or to stake out
- Your current position

Associated **Help** menu (2 screens):

(Displayed by pressing **F1**, removed by pressing **Esc**. Press **PgUp** or **PgDn** to change help menu)



Zoom out: Shrinks the 2D view (scale reduction)

Zoom in: Enlarges the 2D view (scale enlargement)

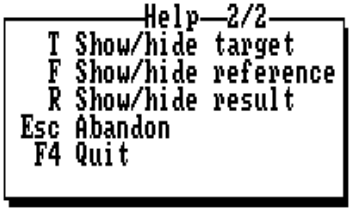
Zoom to fit: Re-computes and updates the scale value so that the view shows only those points which have to be displayed

Center on point: Centers the view around the selected point

Center on position: Centers the view around your current location…

…

Scale: Allows you to fully configure the 2D view from a single screen (see screen below)

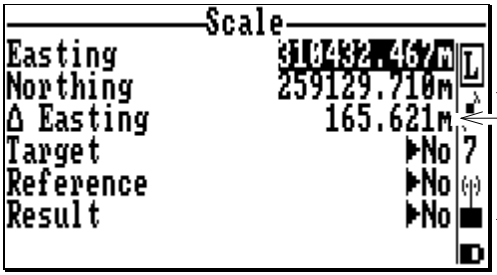


Show/hide target: Shows or hides the target points

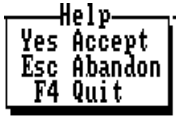
Show/hide reference: Shows or hides the reference points

Show/hide result: Shows or hides the position solutions.

2D view configuration screen (press the **S** key):



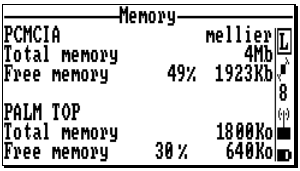
…And the associated **Help** menu:



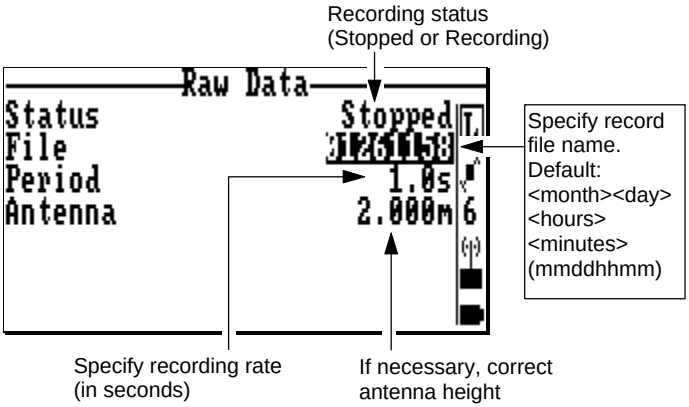
Recording Raw Data on PCMCIA

Before enabling this function, read the memory space available on your PCMCIA. This should help you configure the recording phase in order to avoid getting out of memory before the end of recording.

- Select in the main menu, then **Memory** (4). A new screen appears indicating the type of PCMCIA used and the amount of free memory. Screen example:



- From the same icon, select **Raw Data** (5). A new screen appears allowing you to configure, start, and later stop, the recording of raw data on the PCMCIA. Screen example:



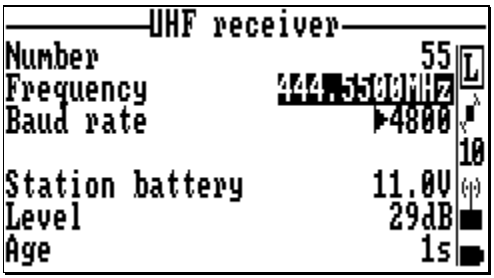
Associated **Help** menu:

- Press the **R** key to start recording raw data
- or press the **S** key to stop the recording in progress.

UHF receiver setting & base station identification

- **Configuring the UHF receiver**

  - From the main menu, select , then **Configure** (1). A new screen appears allowing you to configure your integrated UHF receiver (used for the data link). Example:



  The following parameters should be entered on this screen (in order of appearance):

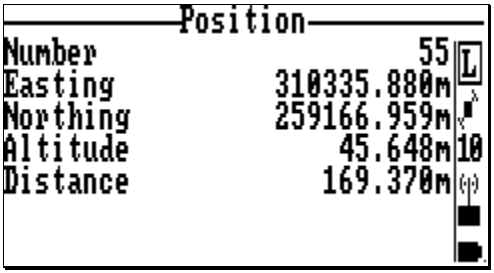
  - Identification number of the base station you want to work with
  - Transmission frequency of this base station
  - Data baud rate configured at this base station (1200 Bd if DSNP code or code/phase format, or 4800 Bd if LRK format) (Ask the person in charge of the base station if you don't know which baud rate should be used)

  Once the above 3 parameters are correct, the lower part of the same screen is updated to provide the following status information (in order of appearance):

  - Current value of battery voltage at the base station
  - UHF reception reserve, in dB, above minimum level required
  - Age of the correction data received through the UHF data link

- **Viewing the characteristics of the selected base station**

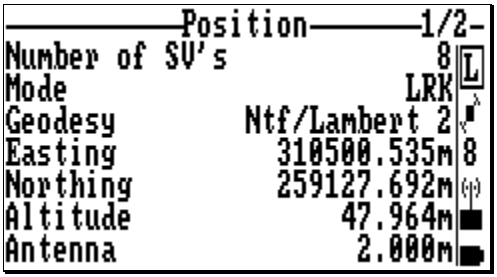
  - From the main menu, select , then **Position** (2). A new screen appears providing the identification and location of the selected base station, as well as the **distance separating your current location from the base station**. Screen example:

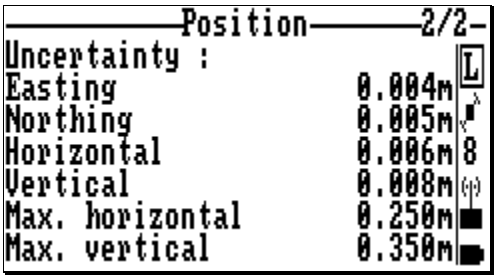


Viewing the solution of your current position

- From the main menu, select , then **Position** (2). A new screen appears providing the solution of your current position. The information is presented on two screens. Use the **PgUp** and **PgDn** keys to change screen.

  Screen examples:

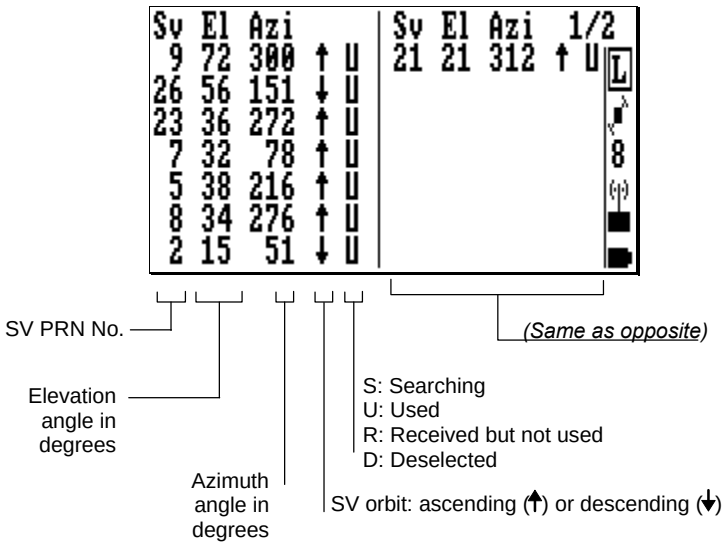




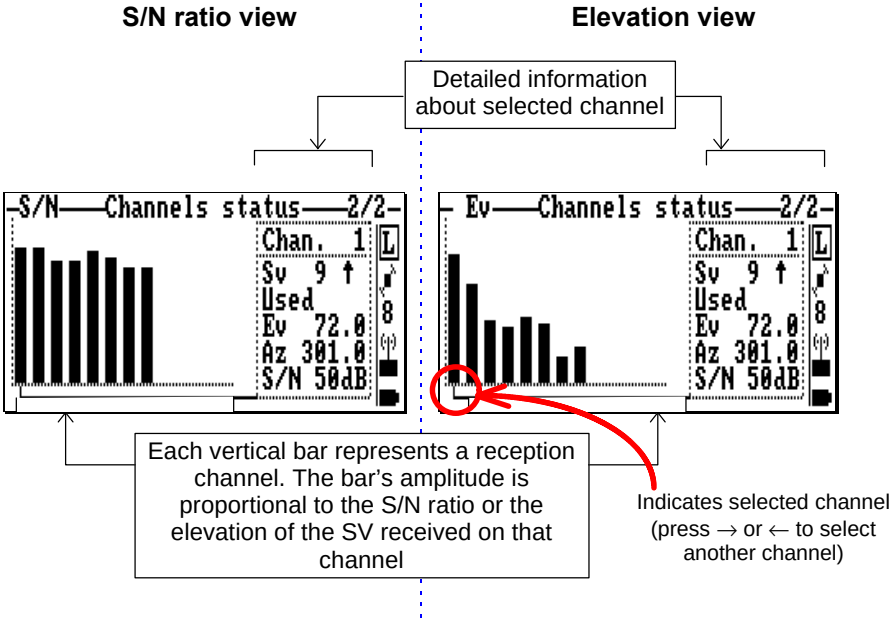
  This function is accessible from anywhere in the program by pressing the **F2** key.

Viewing the status of the GPS constellation

- From the main menu, select , then **Satellites** (3). A new screen appears providing information about the GPS constellation visible from your current position. The information is arranged in two screens. Use the **PgUp** and **PgDn** keys to change screen. Screen examples:



Screen 2/2 contains graphical and alpha-numerical information about the constellation.

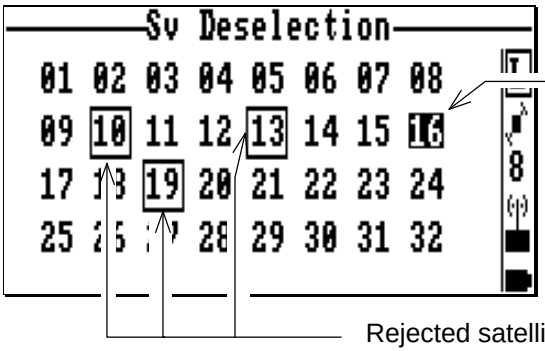


Help menu associated with screen 2/2:

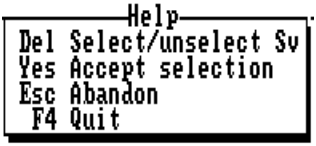
- Press the **N** key to define the number of channels represented on the bar graph (typically 16 or 12)
- Press the **P** key to select which bar graph to show on the screen (either S/N Ratio or Elevation view)
- Use the horizontal-arrow keys to display complete information for the desired channel.

Rejecting satellites

- From the main menu, select , then **SV deselection** (4). A new screen appears allowing you to reject one or more GPS satellites from the position processing.



Associated **Help** menu:



According to context:

- Use the arrow keys to select the PRN of the SV you want to reject or re-select
- Press the **Del** key to reject or re-select the highlighted SV
- Press the **Yes** key to validate all the changes made to the PRN table

Processing & initialisation modes

The rover unit can operate in one of the following processing modes:

1. *Real-time kinematic* (LRK if dual-frequency, KART if single-frequency) achieving accuracies at the centimeter level. In this mode, the unit can be initialized in 4 different ways:

   OTF : ("On the Fly") Initialization with rover unit in motion, start point unknown

   STATIC : Initialization with rover unit at a standstill (to within 1 cm) and point unknown

   ZFIXED : Initialization with rover unit in motion, start point unknown, but rover unit altitude remains constant throughout the initialization phase

   POINT : Initialization from a known point.

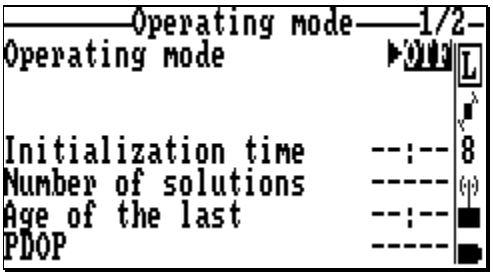
2. *EDGPS* (enhanced DGPS), achieving meter accuracies

3. *GPS*, the less accurate of the three modes

The default processing mode used by your rover unit is **LRK** (or **KART** if L1-only) and the default initialisation mode is **OTF**.

Follow the instructions below if you want to change the default setting:

1. From the main menu, select , then **Operating mode** (1). Screen 1/2 appears.



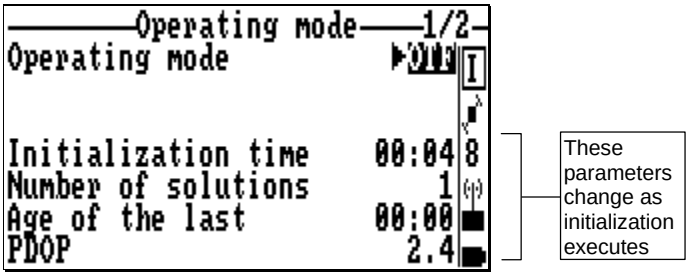
All initialization types can be started from this screen, apart from POINT, which should rather be run from screen 2/2, displayed by pressing the **PgDn** key (see next page).

From either screen (1/2 or 2/2), select the **Operating mode** field and then press the → key. A new dialog box appears asking you to choose a mode:

Selecting OTF, STATIC, ZFIXED or POINT will amount to implicitly choosing the LRK (or KART) mode.

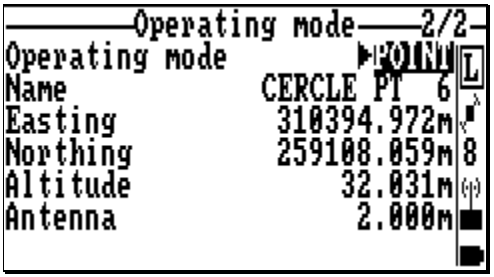
2. Choose an option and then let the rover unit complete the initialisation phase.

For example, if initialisation is run in OTF (LRK), the screen will look like this just at the beginning of this phase:



POINT initialization

Screen 2/2 is designed to start initialization in POINT mode:



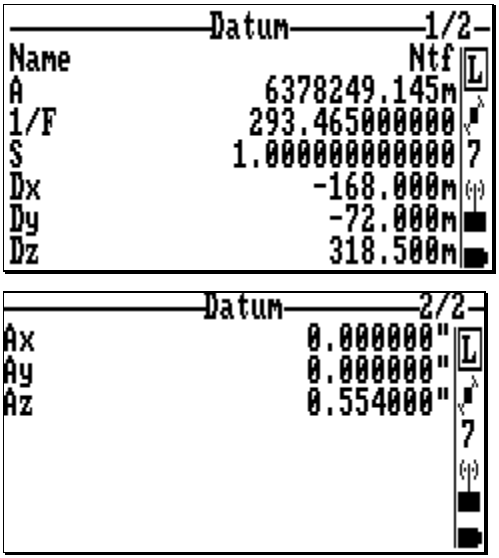
A reference position is displayed which you can edit to be your real position of initialization. You can also do the following from the associated **Help** menu:

According to context:

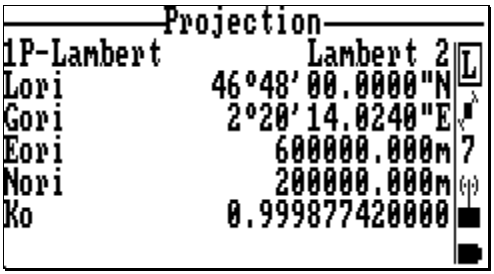
- Press the **F** key to select another point from the list
- or press the **C** key to transfer the current position as the location where the initialization phase should take place.
- then press the **Yes** key to validate the displayed position and start the initialization phase.

Viewing the datum and projection used

- From the main menu, select , then **Datum** (1). The information is arranged in two screens (read-only) as shown in the example below. Use the **PgUp** and **PgDn** keys to change screen.

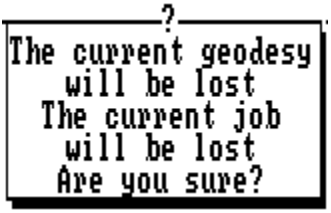


- From the main menu, select , then **Projection** (2). The information is presented on a single screen (read-only) as shown in the example below.



Switching to WGS84

- From the main menu, select , then **Change to WGS84** (3). A warning message will appear asking you to confirm your choice:



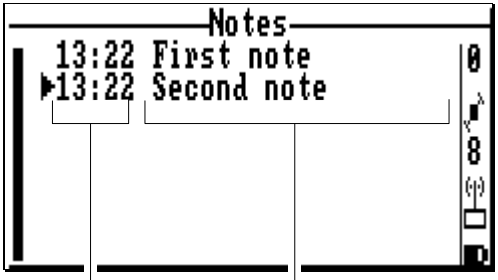
Using the notepad

The notepad is a text file associated with the palmtop (note that it is not associated with the job). This file consists of one or more notes which the operator creates when needed. Whenever the operator creates a note, this new note is placed after the previously created one, at the end of the file. The format of each note is the following:

1: Date
2: Time
3: Name of the job in progress
4: Note as such (text), 150 characters max. in length.

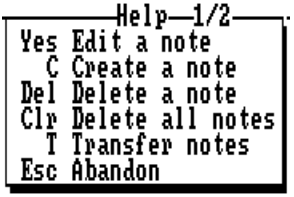
Accessing the notepad is simply obtained by the key combination **Shift+F1** from anywhere in the program. In addition, from within the **Distance** and **Surface** functions, you can directly format a new note containing the information computed in these contexts.

After you press **Shift+F1**, the palmtop displays the list of the notes present in the notepad. In the example below, two notes are listed:



Associated **Help** menu:

(Displayed by pressing **F1**, removed by pressing **Esc**)



According to context:

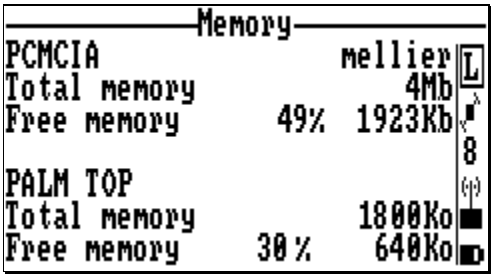
- After selecting a note in the list, press the **Yes** key to edit the content of the note. This command allows you to make changes to the content of a note.
- Press the **C** key to create a new note and write into it
- After selecting a note in the list, press the **Del** key to delete this note
- Press the **Clr** key to delete all the notes
- Press the **T** key to transfer the notepad file (hence all the notes) to the PCMCIA. First you must specify the name of the file which will be created on the PCMCIA:

  (File name in this example: note)

  The extension of the file created on PCMCIA for the notepad is necessarily “txt”.

Free memory space on PCMCIA and Palmtop, deleting geodesy description files

- In the main menu, select , then **Memory** (4). The screen which then appears provides information about the free memory space on the PCMCIA used, and on the palmtop computer. Screen example:

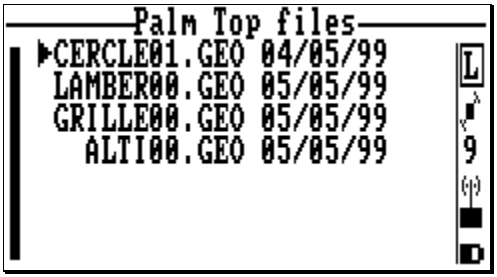


Associated **Help** menu:

(Displayed by pressing **F1**, removed by pressing **Esc**)

- The **F** key allows you to list the *.geo files (geodesy description files) stored on the palmtop.

*.GEO files list example:



Associated **Help** menu:

(Displayed by pressing **F1**, removed by pressing **Esc**)

According to context:

- Press the **Del** key to delete the selected file
- Press the **Clr** key to delete all the *.geo files stored in the palmtop (i.e. all the listed files).

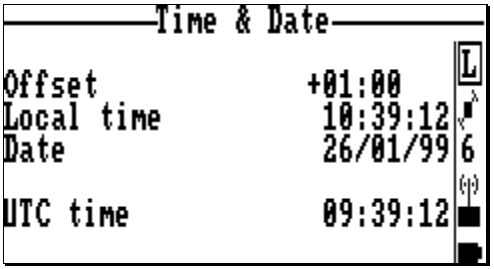
Tools box

Viewing the versions of the system's hardware parts

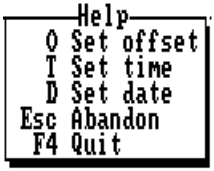
- From the main menu, select , then **Release** (6). The information is presented on a single screen (read-only).

Editing Time & Date

- From the main menu, select , then **Time** (2). The screen which then appears allows you to read or change the local time.

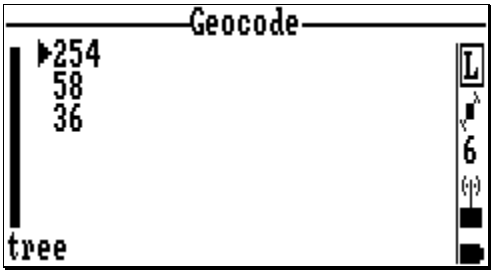


Associated **Help** menu:



Editing Geocodes

- From the main menu, select , then **Geocode** (3). The screen then lists of all the known geocodes. The comment associated with the selected geocode appears at the bottom of the screen. Example:

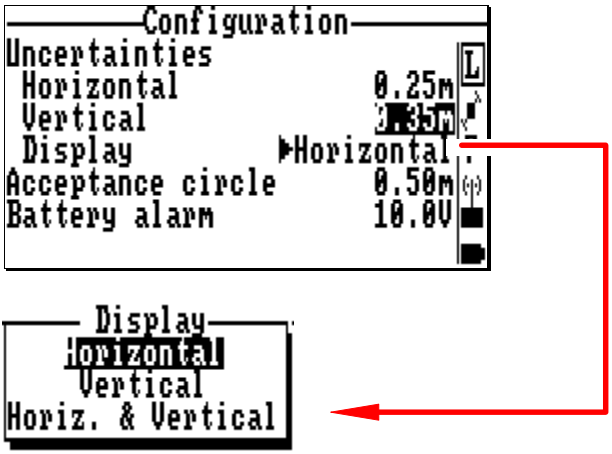


Associated **Help** menu:

Editing uncertainties, acceptable deviation & battery alarm threshold

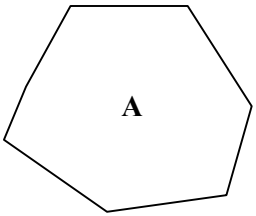
- From the main menu, select , then **Configuration** (4). The screen which then appears allows you to edit the following parameters:
  - Maximum values of uncertainties tolerated on any point that you survey
  - Value of uncertainty to be displayed on log screen when surveying a point
  - Radius of acceptance circle. When arriving at a target, the **OK** message will appear only when the current deviation to the target becomes less than this value.
  - Threshold value of rover unit battery voltage causing the alarm to sound (if current battery voltage less than or equal to this value)

  Screen example:

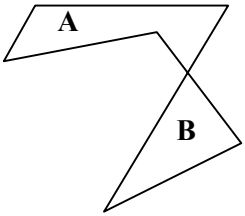


Measuring the surface of an area

This function allows you to compute any surface defined by points that you specify. The surface is defined taking into account the order in which you select points. If the perimeter you define in this way intersects with itself, the computed surface is equal to the difference of the two surfaces then created (in absolute value):

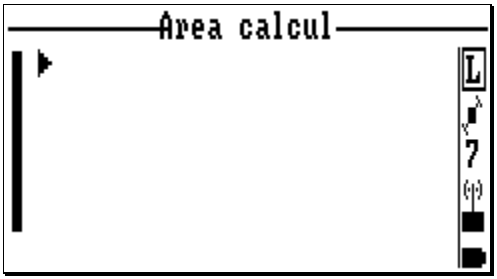


The system will compute the surface of the A area



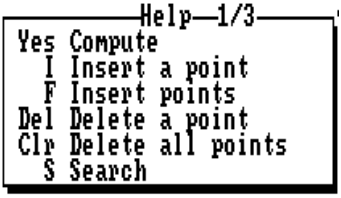
The system will compute |A – B|

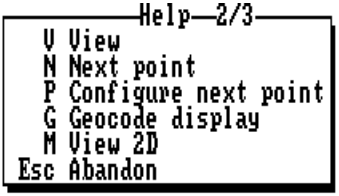
- From the main menu, select , then **Area** (1). The screen which then appears allows you to select the points defining an area:



Associated **Help** menu (3 screens):

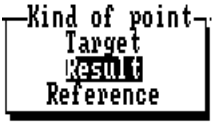
(Displayed by pressing **F1**, removed by pressing **Esc**. Press **PgUp** or **PgDn** to change help menu)





Calculer: Computes the engendered surface
Insert a point: Inserts a point in the definition of the surface
Insert points: Inserts points in the definition of the surface
Delete a point: Removes a point from the definition of the surface
Delete all points: Removes all points from the definition of the surface
Search: Press the **S** key to search for a new point (to be continued in page *4-64*
View: Press the **V** key to view the definition of the selected point
Next point: Press the **N** key to select the point you defined as the "next point" (see below)
Configure next point: Press the **P** key to define the nature of the next point (to be continued in page *4-63*)
Geocode display: Allows you to choose which geocode (1, 2, 3 or 4) should be displayed in the list of points
View 2D: Projects the locations of the points onto a plane (see page *4-69*). This view accurately shows the distribution of the points in the two-dimensional (XY) space.

2. Press the **F** key to insert points into the list of points defining the surface. The following dialog box displays:



3. After making a selection, press the **Yes** key. Another dialog box appears asking you to specify the type of selection you want to do:

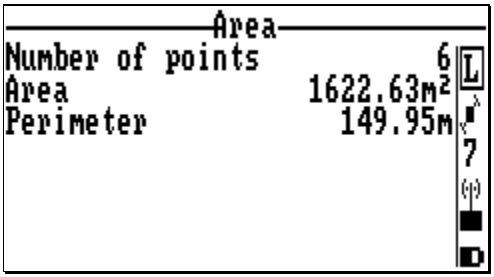
All: you want to select all the points from the selected list

P1...P2: you want to select all the points between two points which you have then to specify (these two points will also be part of the selection)

By name: you want to select all points whose names include a string that you must specify (use * if necessary)

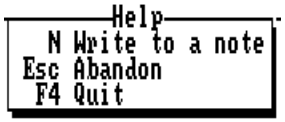
By geocode: you want to select all points whose geocodes include a string that you must specify (use the wild card symbol "*" if necessary).

4. Once the points selection is complete, press the **Yes** key to allow the system to compute the perimeter and surface of the area you have just defined. Then the results appear on the screen. Example:

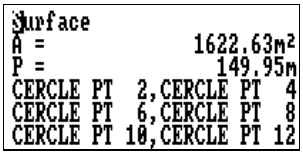


5. From the associated **Help** menu, you can still change the definition of the area, using keys **I**, **F**, **Del**, **Clr**, etc. Every time you change the definition of the area, press the **Yes** key to resume the computation.

Help menu associated with the surface computation screen
(Displayed by pressing **F1**, removed by pressing **Esc**)



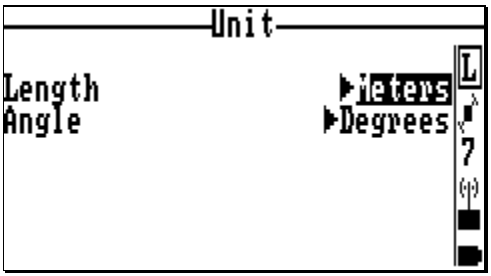
6. If needed, you can write these results into the notepad by simply pressing the **N** key. The data transferred to the notepad, and corresponding to the previous screen, would be formatted as follows in the notepad:



4

Editing Units

- From the main menu, select , then **Unit** (5). The screen which then appears allows you to edit the units used for distances and angles.



Using the palmtop in standalone mode

The palmtop-resident program may be run even if the palmtop unit is not connected to the GPS receiver. In this case, the job on which you can work is necessarily the one you last opened (when the receiver was still connected). The following actions are then possible on that job:

- view the lists of target, reference and result points
- view and create a profile
- view the points coordinates
- view the points graphically, projected onto a plane
- compute distances and surfaces
- read and create notes.

♣

5. Downloading field data

Introduction

Downloading field data requires the use of the *KISS* module from the DSNP *3SPack* software package.

In this section, we will just outline the main steps of field data downloading using this module. It is assumed that the DSNP *3SPack* software package has been properly installed and the dongle allowing the PC to run that package has been connected to the parallel port.

For detailed information on how to install *3SPack* and how to use *KISS*, please refer to the corresponding manual (*3SPack Reference Manual*, Part No.0311366).

Collecting the results of a survey

Back at the office, do the following with your PC:

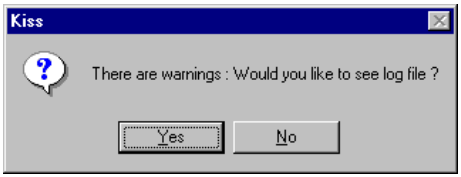
- Run KISS
- Insert the PCMCIA containing the completed job into the drive
- In the toolbar, click or from the **Transfer** menu, select the **Read Results...** command.

  This action is also possible if there is no project open in the KISS window, which will be the case if you work on a PC other than the one used to prepare the job.
- In the **Read Results** dialog box which then appears, select the job you have just completed in the field.

· Click the **OK** button. Once KISS has successfully retrieved the results of the job, these results appear directly on the map. All the points for which solutions are now available are selected (see *Graphic Conventions* used in page *5-3*).

If no project is open in the KISS window, or if the open project is incompatible with the results of the job, the PCMCIA will restore the job as it was written earlier (this JOB file is still present on the PCMCIA) and you will be asked to save this data as a new project. Then KISS will restore the solutions of the points surveyed during the job.

- On transfer completion, a warning message will appear if particular events occurred during the transfer in relation with the **transfer options** chosen for KISS:



The message will prompt you to open the log file so that you can be informed of the nature of these events. If you click the **Yes** button, the log file will be opened using the WordPad text editor of Windows95.

Outside this particular context, you cannot open the log file from KISS. If you need to open it at another moment, use Windows explorer (the log file is stored in ...\3SPack\bin under the name "kiss.log")

- If raw data files are present on the PCMCIA (raw data was recorded by the roving unit during the job), then they will be copied automatically to the corresponding project folder.

Graphic Conventions

- The color of any icon changes when you select it with the mouse pointer:
  - Selected: icon green, point name with dark-blue background
  - Deselected: icon dark-blue, point name with yellow background

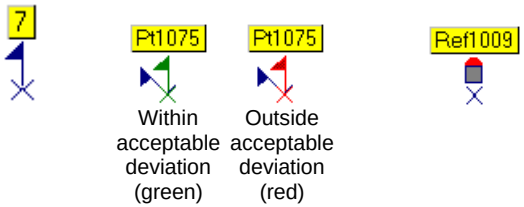
Before surveying

Target points: Reference points:

After surveying

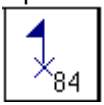
- With **known horizontal system**:

Logged points: Target points: Reference points:



5

- With **unknown horizontal system**:

Logged points: 

Target points:

Reference points:

- Other cases where some reference points may be involved in the following computations. These points will be represented as follows after you validate the results of the processing:

After computing datum shifts:

After computing local grid:

After computing vertical correction:

Editing a point surveyed at the planned location

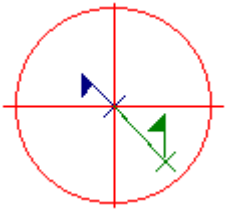
In the toolbar, select and then double-click on the surveyed point (whether a reference point or a target point). The dialog box which then appears includes the following additional information, compared with the same dialog box before surveying the point:

In the **General** tab

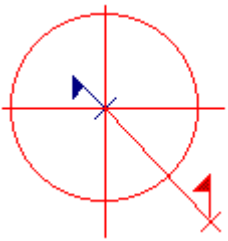
- While only the **Target** radio button could be checked before the survey, you can now check the **Result** or **Error** radio button:
  - Checking the **Result** radio button will cause the coordinates of the position solution to appear just below as **E**, **N** and **H**. Note that these coordinates are dimmed (no changes allowed)
  - Checking the **Error** radio button will cause the components of the deviation between the planned and measured position to appear just below as **DE**, **DN** and **DH**. The **Delta** figure just below stands for the modulus of the deviation vector. This figure will be re-computed if you change the type of the point (1D, 2D or 3D for a reference point, 2D or 3D for a target point), which you can easily do by simply checking/clearing the check buttons associated with **DE**, **DN** and **DH**.

- In this tab, opposite these results, a diagram illustrates the position solution. In the examples below, the radius of the circle represents the 2D projection of the specified **acceptable deviation**.

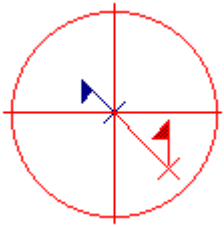
  A. Target point whose solution is located within the acceptable deviation limit (vertical flag and segment in green):



  B. Target point whose solution is located outside the acceptable deviation limit (vertical flag and segment in red):



  C. 3D target point whose solution is located outside the acceptable deviation limit due to the vertical component of the deviation (vertical flag and segment in red although they remain within the circle):



- A new read-only tab is added (**Details**) containing the complete **description of the position solution**:

Date Date & time of survey

Origin Name of the job during which the point was surveyed

Operator Name of the operator who made the job

Process Name of the processing method used (LRK A, LRK R, etc.)

GNSS radio button Check this button to display the WGS84 coordinates of the position solution. This causes the lower part of the dialog box to show all the components of this solution. The definition of the vertical components (H84 and DH) are recalled graphically on the diagram in the right-hand part of the dialog box

L84, G84, H84 WGS84 coordinates of the antenna

DH GPS antenna height above the ground when surveying the point

Correlation Matrix Components of the correlation matrix

DGNSS radio button Check this button to display the WGS84 coordinates of the reference station used in the surveying of the point. This causes the lower part of the dialog box to show the identification and coordinates of this station, as received by the roving unit through the data link. The distance and direction to the target point are illustrated on the diagram in the right-hand part of the dialog box.

The illustration includes scale information. The station identification is also recalled in this diagram.

L84, G84, H84	WGS84 coordinates of the reference station, as received by the roving unit
Baseline	Measured distance between target point and reference station
Correlation Matrix	As the correlation matrix in fact qualifies the baseline measurement rather than the position solution alone, it is maintained in the lower part of the dialog box, whether the GNSS or the DGNSS button is checked.

Editing a logged point

Same as a planned point (see page *5-5*) except that neither a target nor a deviation error is reported in the **General** tab.

Editing a planned point surveyed through offset procedure

In the toolbar, select and then double-click on the surveyed point (whether a reference point or a target point). The dialog box which then appears includes the following additional information, compared with the same dialog box before surveying the point:

In the **General** tab

- While only the **Target** radio button could be checked before the survey, you can now check the **Result** or **Error** radio button:
    - Checking the **Result** radio button will cause the coordinates of the position solution to appear just below as **E**, **N** and **H**. Note that these coordinates are dimmed (no changes allowed)
    - Checking the **Error** radio button will cause the components of the deviation between the planned and measured position to appear just below as **DE**, **DN** and **DH** (necessarily all “0.000 m). The **Delta** figure just below stands for the modulus of the deviation vector (also “0.000 m).
- In this tab, opposite these results, a diagram illustrates the position solution (the target and the measured point necessarily coincide).

Additional tabs are shown: **Offsets** , **P1** , **P2** and possibly **P3** and **P4** in the case of “intersection” offset (see next pages).

Offset Tab

This tab identifies the type of offset procedure that was performed in the field, provides the coordinates of the points involved in that procedure and locates precisely the planned point with respect to these points.

Mode Lateral, linear or intersection

P1 P2 (P3 P4) radio buttons Check the radio button corresponding to the point you want to display

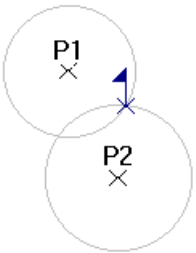
- **E, N, H** Coordinates of the selected point (Pn)

P1P (Lateral or linear offset only) Distance from P1 to the target (P)

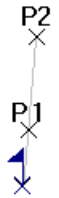
P2P (Lateral or linear offset only) Distance from P2 to the target (P)

P is (Lateral or linear offset only) Gives the location of the target with respect to the "oriented" segment [P2P1]. This means that if an observer is located at P2 and watches P1, then P will be seen either on the left or on the right side of this segment (as explained in the lower pane).

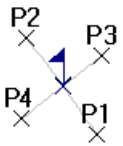
In this tab, opposite these results, a diagram illustrates the position solution:



Lateral offset



Linear offset



Intersection offset

P1, P2, P3 or P4 tab

Each of these tabs is much similar to the **Details** tab obtained for a point surveyed at its planned location.

Date Date & time of survey

Origin Name of the job during which P1, P2, (P3 or P4) was surveyed

Operator Name of the operator who made the job

Process Name of the processing method used (LRK A, LRK R, etc.)

GNSS radio button Check this button to display the WGS84 coordinates of P1, P2, P3 or P4. This causes the lower part of the dialog box to show all the components of this solution. The definition of the vertical components (H84 and DH) are recalled graphically on the diagram in the right-hand part of the dialog box

L84, G84, H84 WGS84 coordinates of antenna at P1, P2, P3 or P4

DH GPS antenna height above the ground when surveying the point

Correlation Matrix Components of the correlation matrix

DGNSS
radio button — Check this button to display the WGS84 coordinates of the reference station used in the surveying of P(n). This causes the lower part of the dialog box to show the identification and coordinates of this station, as received by the roving unit through the data link. The distance and direction to P1, P2, P3 or P4 are illustrated on the diagram in the right-hand part of the dialog box. The illustration includes scale information. The station identification is also recalled in this diagram.

L84, G84, H84 — WGS84 coordinates of the reference station, as received by the roving unit

Baseline — Measured distance between point and reference station

Correlation Matrix — As the correlation matrix in fact qualifies the baseline measurement rather the position solution alone, it is maintained in the lower part of the dialog box, whether the GNSS or the DGNSS button is checked.

Editing a logged point surveyed through offset procedure

Same as a planned point surveyed in the same context (see page *5-9*), except that neither a target nor a deviation error is reported in the **General** tab.

Exporting results in the desired format

- From the **Edit** menu or from the Map Shortcut menu (accessible from anywhere on the map by clicking the right mouse button), select the **Export Results** command.
- In the dialog box which then appears, select the export mode (**Export to File** or **Export to 3SPack**). Then do one of the following:

- **Exporting to a File**
  - Click the **Add** button to choose the point(s) to export from the active project
  - Select the surveyed point(s) from the list and click the **OK** button
  - Define the export file by specifying its path, name and format (DXF or other)
  - Click the **Go** button to start exporting the points.

- **Exporting to 3SPack database**

  Same as **to a File**, except that you just need to specify the points
  - Click the **OK** button

    All points will be exported as Sites

    All logged trajectories will be exported as "3SPack" Trajectories

- **Creating new user formats for exporting results to a file**
    - Click the **User formats** button and then the **New** button. In the dialog box which appears, enter the definition of your format (see *3SPack Reference Manual*, Part No.0311366, section 3, *Creating a user format*).

Saving PCMCIA files on your computer

A recommended practice after, or before, reading the results of a project is to save the corresponding file (*.res) under a different name on the disk of your computer. By doing this, you will gradually create a library of archive files which might be, at any time, of the greatest interest.

- Insert the PCMCIA into the drive
- Using windows95 explorer, list the files contained in the PCMCIA
- Copy the interesting file to the dedicated directory on the PC disk
- Because the result file for a given project is always the same, rename this file on your disk.
- Remove the PCMCIA.

Post-processing the raw data collected during a job

See *3SPack Reference Manual*, Part No.0311366, section 3. ♣

A. Introduction to GNSS

A

GPS Constellation

The GPS system (Global Positioning System) consists of three segments:

- Space segment
- Control segment
- User segment

The Control segment is made up of monitoring stations distributed along the equator. They are used to pick up the signals from the satellites and relay the data they convey to a master station located in Colorado Springs (USA). The data collected are processed, corrected, filtered and finally uploaded to the satellites that broadcast them through a navigation message (ephemerides, almanacs, clock corrections).

The Space segment consists of 24 satellites (often referred to as "SVs" which is an abbreviation for Space Vehicles) orbiting approximately 20200 km above the earth's surface, so that at least four satellites can be simultaneously in view, round the clock, anywhere on earth. The satellites are distributed over 6 orbit planes inclined 55° with respect to the equatorial plane. Each satellite completes an orbit once every 12 hours approximately. From any point on earth, a satellite remains in view for 5 hours (maximum) above the horizon.

The user segment is naturally that which means most to us. It is made up of all the marine, land or air-borne applications deciphering and using the signals received from the satellites.

From a user's point of view, the user segment consists of a receiver capable of recording the GPS information so that it can be processed at a later date or a receiver computing a position in real time with an accuracy depending on the signals used.

Signals

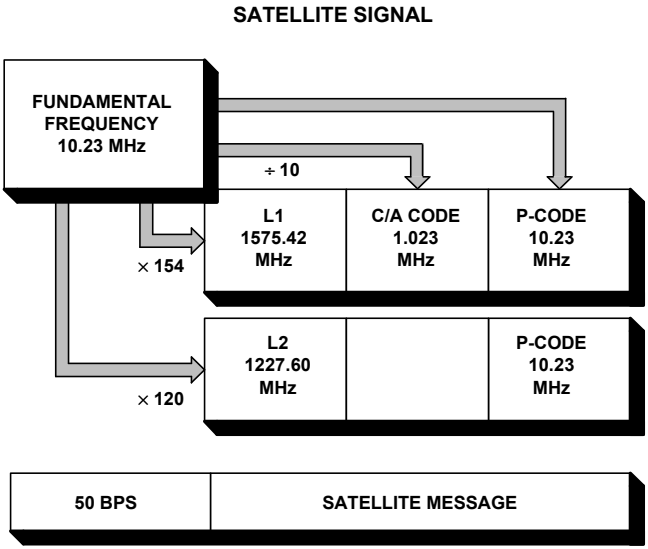
The signals transmitted by the satellites fall into two categories: signals used to control the system, and signals used for measurements within receivers (user segment).

The first type of signal is transmitted in the S-band on the following frequencies:

- 1 783.74 kHz for links from the control station to the satellites
- 2 227.5 kHz for links from the satellites to the monitoring stations.

The second type of signal is for signals known as L1 and L2, transmitted in the L-band, on the following frequencies:

- L1: 1 575.42 kHz
- L2: 1 227.6 kHz



A

Navigation Message

The Navigation Message contains the necessary information for the description of the constellation and for the position computation. The message includes orbital Keplerian parameters precisely defining the orbits of the satellites. It also includes parameters used to partially correct system errors (e. g. signal propagation errors, satellite clock errors, etc.).

The complete message is contained in a data frame that is 1500 bits long, with a total duration of 30 seconds (i. e. the data transmission clock rate is 50 bits/second). The 1500-bit frame is divided into five 300-bit subframes, each with a 6-second duration. Each subframe consists of 10 words of 30 bits each. Each word takes 0.6 second to transmit.

The content of subframes 4 and 5 changes on a page-roll basis: it changes on every frame and repeats every 25 frames. As a result, it takes at least 12 1/2 minutes to log the entire navigation message.

GNSS

GENERAL DESCRIPTION

Satellite navigation systems are now used in scores of applications worldwide. The best known two systems in operation as of today are:

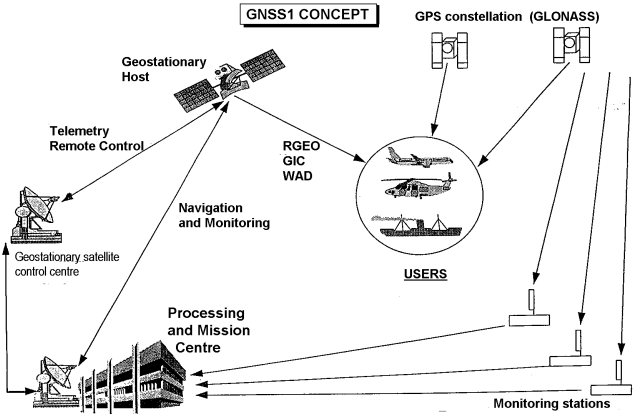
- The US GPS (Global Positioning System) which is the most complete,
- The Russian GLONASS (GLObal NAvigation Satellite System).

As both these systems are originally designed for military applications, they are entirely under the control of the respective Defense Department of the two countries. As a result, civilians cannot be sure of being allowed full access to the signals in critical periods of time. Moreover, the accuracy achieved using the non-encrypted signals is only on the order of a few tens meters.

All those aspects led the civilian community to devise a totally new system known as GNSS (Global Navigation Satellite System).

In future, a complete constellation —GNSS2— should provide civilian users with signals and data allowing them to compensate for any shortcomings in the navigation systems at sea, on land or in the air.

The current GNSS1 is the first phase in that scheme, based on the augmentation of the GPS service through geostationary satellites.



Purpose

The GNSS scheme serves three major purposes:

Complementing the range measurements with geostationary satellites (R_GEO),

Controlling the integrity of the navigation system (GIC: GPS Integrity Control),

Broadcasting differential corrections over a wide area (WAD: Wide Area DGPS).

A

GNSS concept

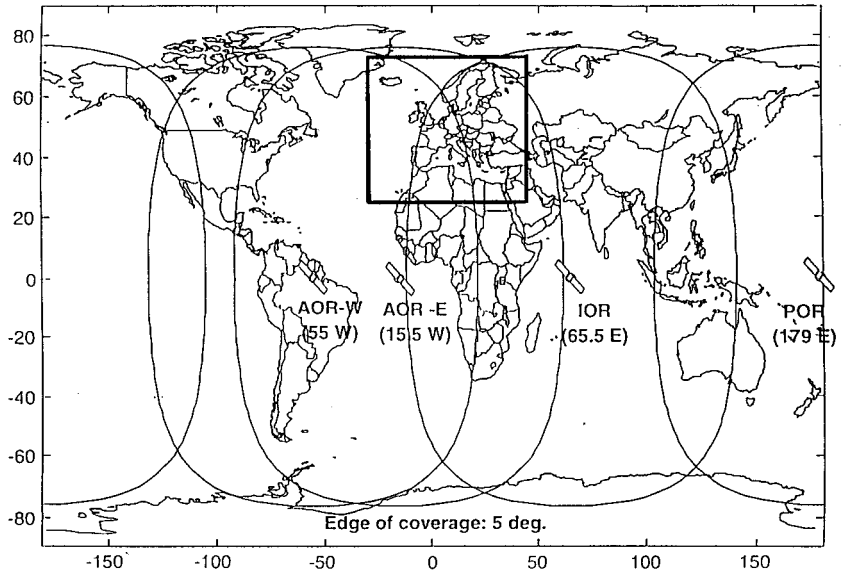
The GNSS system consists of the following elements:

Stations monitoring the navigation system (GPS, GLONASS), distributed over the area to be covered, allowing continuous monitoring of the system,

A Processing and Mission Center that collects and computes the data required for the performance of the system,

A control center for the geostationary satellites, uploading the necessary data to the geostationary satellites,

One or more geostationary satellites broadcasting the data (R_GEO, GIC, WAD) over the area to be covered.



The different systems

There are three systems as of today:

- For the American continent: WAAS (Wide Area Augmentation System)
- For Europe: EGNOS (European Geostationary Navigation Overlay System)
- For Japan: MSAS (Multi-transport Satellite Augmentation System)

♣

B. Introduction to the DSNP Scorpio 6000 series

Preamble

Welcome to the DSNP *Scorpio 6000 series*. We hope that this equipment will give you full satisfaction.

The DSNP Scorpio 6000 series has been designed for land surveys. As you know, the modular concept adopted in the design of the 6000 series has made it possible to optimize the purchase of your surveying equipment by allowing you to buy just the necessary pieces of equipment needed for your applications.

From the operational point of view, the DSNP Scorpio 6000 series can be divided into two categories:

- Recorders (600x xP) for post-processed land surveys (collected data necessarily post-processed by 3SPack software after field operations)
- Receivers (600x xK) with integrated real-time processing KART (Kart Application Real Time) or LRK® (Long Range Kinematic). Post-processing with 3SPack is also possible, but not necessary.

All the products from the Scorpio 6000 series come by pairs:

- A roving receiver (600x Mx)
- A stationary receiver (or station) (600x Sx)

  except for post-processing, in which 2 600x SP units are required.

In this section, we will describe the whole 6000 series, from the basic system up to the most sophisticated one. In this description, you will recognize the equipment you have just purchased, you will read the preliminary instructions on how to control and operate it and you will be informed on how to make extensions to your initial configuration.

The heart of your equipment

The heart of your equipment is what we call the "GNSS engine". All the products from the Scorpio 6000 series are built around this engine.

The GNSS engine comes in two versions. Depending on your purchase, your equipment will use an L1 single-frequency engine, or an L1/L2 dual-frequency engine.

If necessary, your equipment will be easily transformable from single to dual-frequency by purchasing the L1-to-L1/L2 upgrade.

Operating environment

Each of the products in the 6000 series is fitted with specific integrated or attached user-interface and display screen giving the field operator full control of his/her receiver.

For recorders (600x xP), the downloading of field data to a computer should be made via the receiver's A port ("COMPUTER" RS232 port).

The clues to product naming in the Scorpio 6000 Series

In the Scorpio 6000 series:

- The "1" suffix refers to a single-frequency (L1) engine
- The "2" suffix refers to a dual-frequency (L1/L2),
- "P" refers to post-processing-only capability
- "K" refers to real-time processing based on the KART or LRK® method
- "M" refers to a roving receiver (**M**obile unit)
- "S" refers to a stationary receiver (Base **S**tation).

Product applications

- The 6001 MP (mobile) and 6001 SP receivers (station) are intended for land surveys conducted typically according to the Rapid-Static or Kinematic post-processing method.

  After field operations, the collected data should be downloaded to a computer running 3SPack (DSNP Satellite Survey Package) for post-processing.

- The 6002 MP (mobile) and 6002 SP receivers (station) are intended for land surveys conducted typically according to the Long Range Rapid-Static or Long Range Kinematic post-processing method.

  After field operations, the collected data should be downloaded to a computer running 3SPack (Satellite Survey Software Package) for post-processing.

  Compared with the 6001 MP and the 6001 SP, these receivers offer similar accuracies but over larger areas, thanks to their dual-frequency engine.

- The 6001 MK (mobile) and 6001 SK (station) are the two pieces of equipment required for real-time KART land surveys. With this equipment, a UHF data link is established between the two receivers to provide the mobile with corrections generated at the station.

- The 6002 MK (mobile) and 6002 SK (station) are the two pieces of equipment required for real-time LRK® land surveys. With this equipment, a UHF data link is established between the two receivers to provide the mobile with corrections generated at the station.

Product Selection Guide

	6001 MP & SP	6002 MP & SP	6001 MK & SK	6002 MK & SK
Software options				
L1 to L1/L2 Upgrade	✓		✓	
Real-time upgrade (KART)	✓			
Real-time upgrade (LRK®)		✓		
Hardware Options				
Additional battery pack	✓	✓	✓	✓
Additional battery charger	✓	✓	✓	✓
Tripod and tribrach	✓	✓	✓	✓
Post-processing			✓	✓

B

Specifications

Physical

	Dimensions in mm (H×W×D)	Weight in kg (without battery)
6001 MP or SP	130×260×220	3.5
6002 MP or SP	130×260×220	3.5
6001 SK	130×260×250 (1)	4.5 (with UHF transmitter)
6001 MK	130×260×220	3.7 (with UHF receiver)
6002 SK	130×260×250 (1)	4.5 (with UHF transmitter)
6002 MK	130×260×220	3.7 (with UHF receiver)

(1) With plug-in UHF transmitter

Electrical

	Power Drain in W	DC Power voltage range, in V
6001 MP or SP	11	10 to 15
6002 MP or SP	13.6	10 to 15
6001 SK	26 (1)	10 to 15
6001 MK	15	10 to 15
6002 SK	28 (1)	10 to 15
6002 MK	17	10 to 15

(1) With 4-W radiated power

Environmental

Receiver operating temperature		
(all receivers)	:	– 20°C to + 55°C
except for 600x xK	:	– 10°C to + 55°C
Receiver storage temperature	:	– 40°C to + 70°C
GPS Antenna operating temperature	:	– 40°C to + 70°C
UHF Antenna operating temperature	:	– 40°C to + 70°C
Humidity	:	100% fully sealed

Receiver unit standard features

- 12 GPS channel (L1) receiver + 4 WAAS/EGNOS-compatible channels (6001)
- 12 GPS channel (L1+L2) receiver, fully operational with P-code encryption, + 4 WAAS/EGNOS-compatible channels
- Multi-path mitigation techniques and low-noise observables
- GNSS raw data output: 10-Hz rate ASCII or binary formats

Built-in UHF receiver (for 600x MK)

Frequency band	:	410-470 MHz
Channelizing	:	12.5 kHz
Modulation types	:	GMSK (4800 bits/s)
		DQPSK (1200 bits/s)

Plug-in UHF transmitter (for 600x SK)

Frequency band	:	410-470 MHz
Channelizing	:	12.5 kHz
Output power	:	4 W
Modulation types	:	GMSK (4800 bits/s)
		DQPSK (1200 bits/s)

B

6001 MP/6001 SP specific performance data

- Rapid Static accuracy: 5 mm + 1 ppm up to 15 km
- Kinematic accuracy: < 2 cm up to 15 km

6002 MP/6002 SP specific performance data

- LR Rapid Static accuracy: < 2 cm up to 50 km
- LR Kinematic accuracy: < 2 cm up to 15 km
- LR Kinematic accuracy: < 5 cm up to 50 km

6001 MK/6001 SK specific performance data

- Automatic OTF ("On the Fly") initialization from 5 SVs within 12-km baseline
- Operational range: up to 20 km
- KART fix rate: 10 Hz with latency < 0.1 second
- Accuracy: 5 mm + 1 ppm (95%) at 1-s rate, 5 SVs or more, HDOP < 4
- UHF coverage: up to 40 km, depending on installation conditions (particularly station antenna height compared with mobile antenna height)

6002 MK/6002 SK specific performance data

- Automatic OTF ("On the Fly") initialization from 5 SVs
- Operational range: up to 50 km
- LRK® fix rate: 10 Hz with latency < 0.1 second
- LRK® accuracy: <1 cm at 20 km; <2 cm at 40 km (at 1-s rate
- UHF coverage: up to 40 km, depending on installation conditions (particularly station antenna height compared with mobile antenna height).

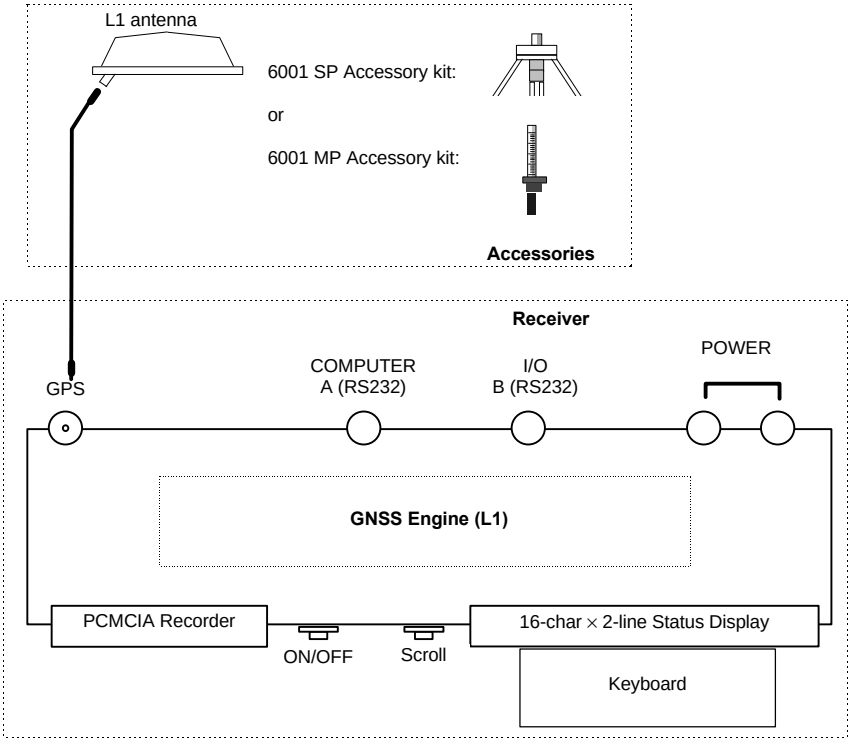
All GPS receivers are subject to degradation of position & velocity accuracy under US selective availability (S/A) policy. The geometry of the GPS constellation also influences the accuracy.

B

Block Diagrams

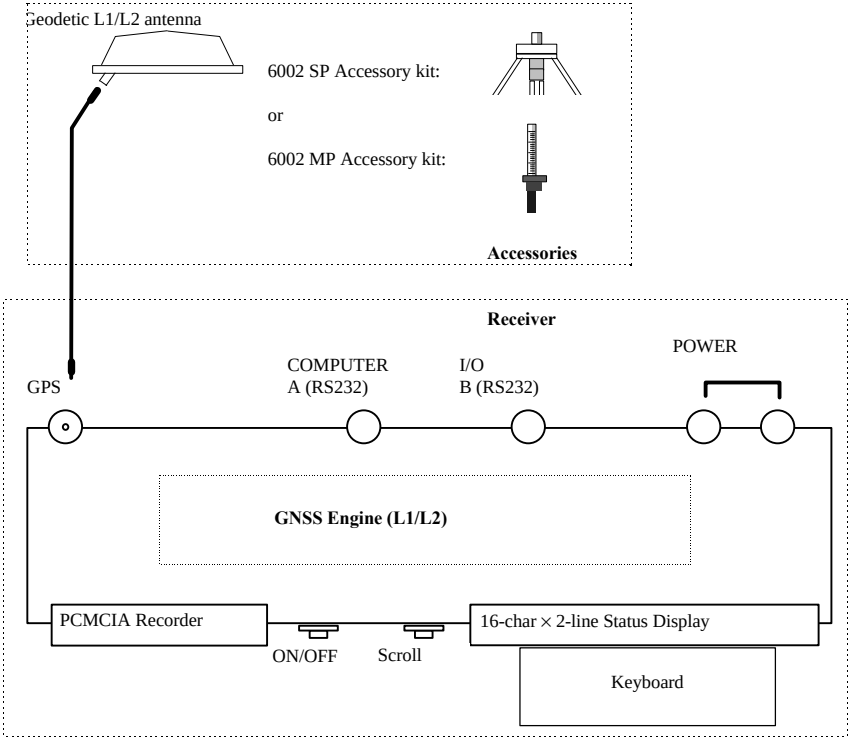
6001 MP & 6001 SP

The 6001 MP and 6001 SP are simple GNSS single-frequency recorders fitted with a PCMCIA drive. They differ from each other only by their accessory kits.



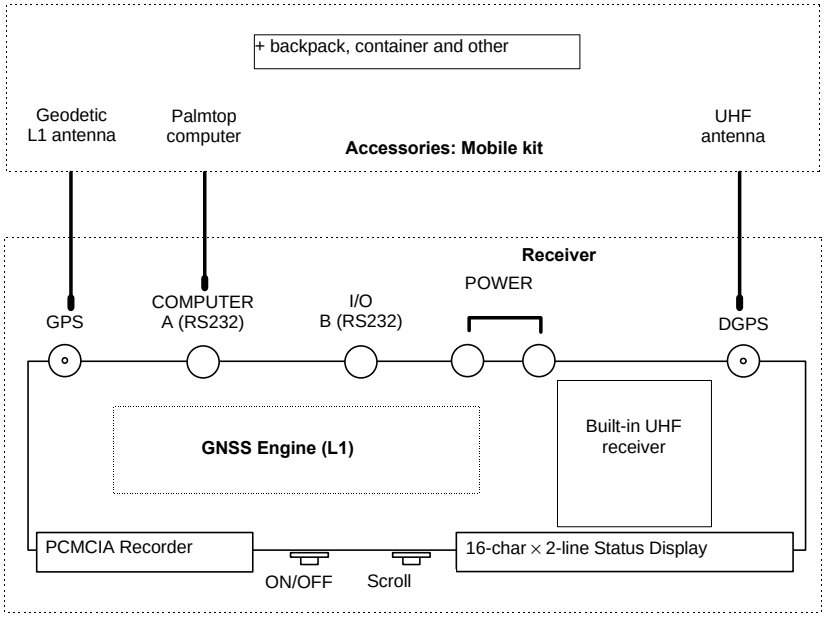
6002 MP & 6002 SP

Like the 6001 MP and 6001 SP, the 6002 MP and 6002 SP are simple GNSS PCMCIA recorders. They differ from each other only by their accessory kits.

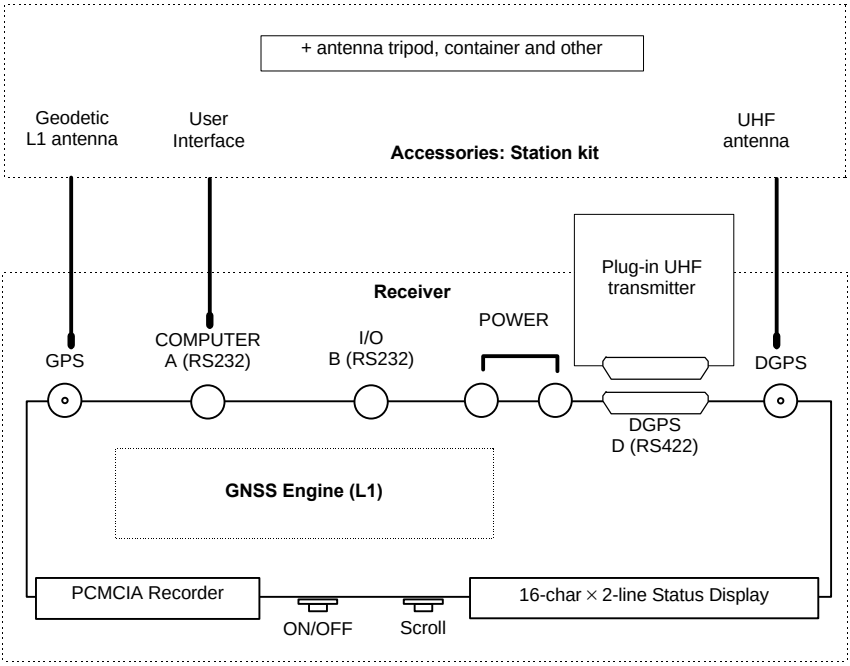


B

6001 MK Rover Unit

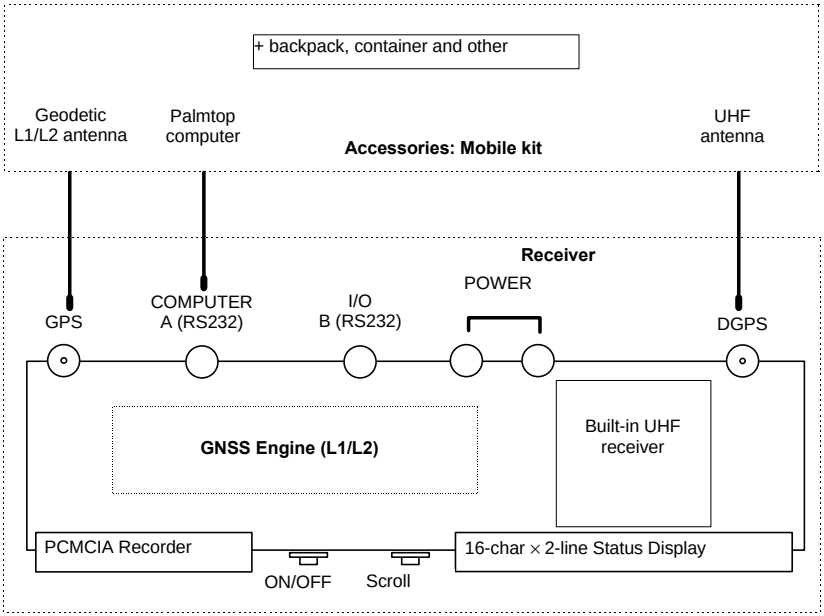


6001 SK Base Station

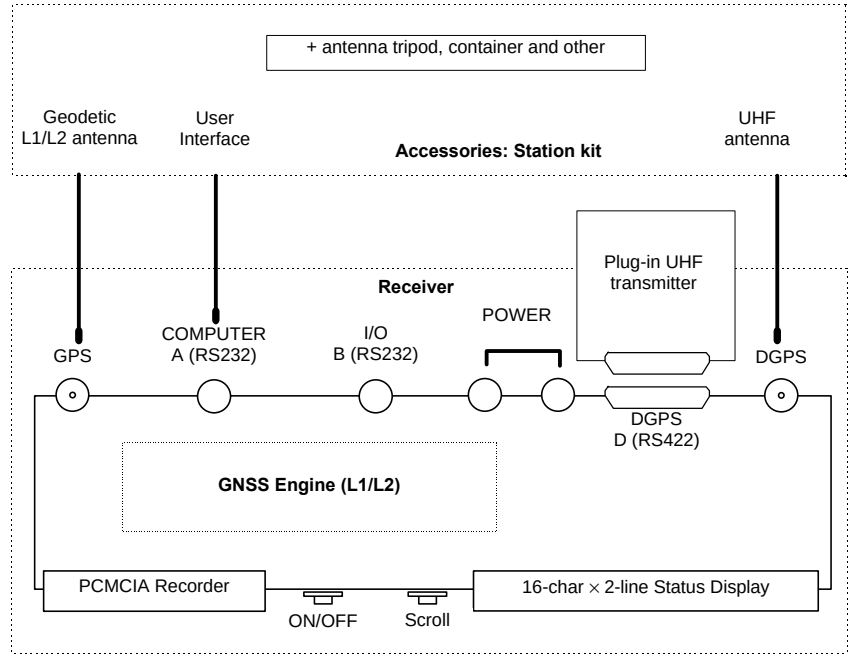


B

6002 MK Rover Unit



6002 SK Base Station



♣

C. KART/LRK General Principles

KART

Theory of operation

Typically, the algorithms used to determine the values of ambiguous terms go through the following steps:

- Defining a search volume, built on the basis of the approximate position, according to its uncertainty (covariance),
- Computing all possible solutions in the search volume,
- Choosing the best possible solution (minimum variance),
- Validating the solution (through comparison with the second best solution).

Some conditions and tests are applied at different levels so that a priori inconsistent solutions can be rejected.

This scheme can be used for dual-frequency receivers because the number of possible solutions remains relatively low within the search volume. In single-frequency receivers, it is not reasonably applicable (in real time) due to the large number of possible solutions.

This is why the scheme used in the KART system is radically different:

- Recursive computation of an approximate solution, using the phase and pseudo-ranges triple difference. The solution tends towards the actual solution over time.

- On each measurement epoch, computation of a double-difference solution, with a fixed value for ambiguous terms (integers). The solution results from successive updatings, starting from the approximate solution, first fixing the integers for the satellite pair less sensitive to the initial position error and finishing with the most sensitive pair.
- Validation of these solutions with fixed ambiguous terms (traditional test on residuals, complemented by a test for their changes over time).
- Check for the repeatability of the solution over a given period.

This scheme dramatically differs from the traditional methods. The following differences can be pointed out:

- No search volume is required, meaning that the method does not rely on any hypothesis on the quality of the approximate solution, so the actual solution does not risk being left outside a search volume that may be improperly estimated.
- No statistical analysis on multiple solutions.
- No Kalman filter or statistical analysis. More generally, no stochastic models or statistical distributions need to be a priori determined.

The methods based on statistical tests are naturally attractive, but they are only efficient on condition that the stochastic models can be determined properly. Unfortunately, it is very difficult to determine precise models for the errors affecting the GPS measurements. The multipath effects or the propagation errors, to name but a few, are not easy to evaluate. As a result, the so-called 'optimal' methods are not so optimal in practice, as they are to much dependent on the a priori models.

Characteristics

The maximum range and the initialization time are the main two aspects to be considered in order to achieve the best possible results with a real-time kinematic system.

The maximum range is defined as the maximum distance from the reference station within which the user will fully benefit from the performance of the system. Two major factors may affect the maximum range:

- Physical phenomena: in the case of KART, just like in any single-frequency system, the maximum range is mostly limited by the uncorrelation of ionospheric errors. This phenomenon is significant at distances in excess of 10 to 15 km (for a medium latitude). Generally such distances can be covered with the KART even though longer initialization times are required.
- Data transmission and the techniques implemented to provide a reliable link from the reference station to the mobile. The traditional UHF DGPS systems from DSNP have a long record of field-proven reliability in excess of the requirements of the KART.

To sum up, it is advisable to install both the GPS and UHF antennas of the reference station at a location clear of any obstructions and high enough to cover the area of interest and preclude any multipath effects that otherwise might affect the performance of the system. Even if the UHF link allows operations over longer ranges, initializations should be performed within no more than 10 to 15 km of the reference station.

LRK

The advantages of using the two GPS frequencies lie in that this makes it possible to cover longer ranges and cut down the initialization time while increasing the reliability of the initialization process.

- As far as maximum range is concerned, the uncorrelation of ionospheric errors no longer prohibits operations more than 15 km away from the reference station.

  We can compensate for uncorrelation by combining the measurements taken on L1 and L2 (ionospheric delays are inversely proportional to the squared frequency).

  Then the remaining limitations arise from the uncorrelation of tropospheric errors and from the errors on the broadcast ephemerides, but those errors have a much smaller impact in terms of amplitude. As a result, the only practical limitation is dependent on the quality of the radio link (several tens kilometers in the case of the DSNP UHF link).

- When it comes to solving for the ambiguous terms in carrier phase measurements, resorting to two frequency is still more beneficial. Combining the two frequencies makes it possible to get a wavelength of 86 cm (L2-L1), which decreases the number of solutions that may be retained around the approximate position and increases the separation between any two possible solutions. All those features allow the initialization time to be substantially reduced, and they significantly increase the reliability of the solution.

As many tests have been conducted that reveal the merits of the technique used in the KART system, the same processes can be used with the following enhancements:

- Recursive computation of the approximate solution: in addition to the pseudo-ranges (C/A code) and phase triple difference on L1, a triple difference is computed on the phase of L2 and on L1/L2 pseudo-ranges (P/Y code). This leads to a faster convergence towards the actual solution.
- On each epoch, computation of a double-difference solution —only one— with resolved integers. With the LRK method, however, the position solution is computed in two steps. Starting from the approximate solution, in the first step, a «coarse» solution is computed through a linear combination of the measurements made on L1 and L2 (86 cm integer ambiguity instead of 19 cm), on wide windows. The solution, more accurate —albeit coarse— than the approximate position, is used to solve for integers in the second step with higher accuracy.
- Final computation of the position: over long distances, using the two frequencies compensates for ionospheric delays and increases the covered area.
- Solution validation: testing the residuals on L1 and L2.

- The checking for the repeatability of the fitting solution is used only in the case of critical conditions (e. g. only four satellites received).

To sum up, the LRK system can be used farther from the reference station than the KART and allows shorter initialization times to be achieved, meaning that it can be used in critical environments (forests, urban areas, harbors, etc.). However, this does not relieve the user of the necessity of installing the reference station antenna in an open area, high enough to cover the desired range. ♣

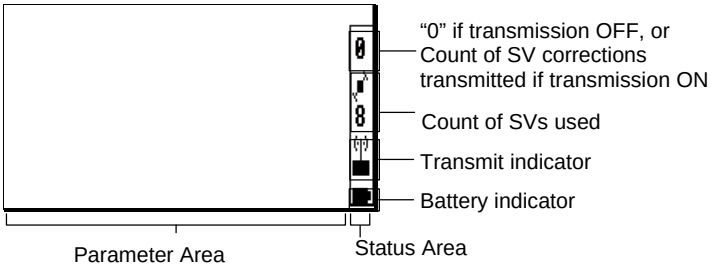
D. Base Station Control

Introduction to Palmtop software

On the palmtop, remember you always use the same program ("Palmtop Software") whether you are programming a base station or surveying with the rover unit. After detecting the type of the attached receiver (i.e. a base station or a rover unit), this program will configure itself to offer the right interface.

Palmtop display

All screens are divided into two distinct areas as shown below. The status area is permanently shown.



Count of SVs used:

: Blinking icon if the count of SVs drops and remains below 4

Transmit indicator:

: Respectively OFF and ON.

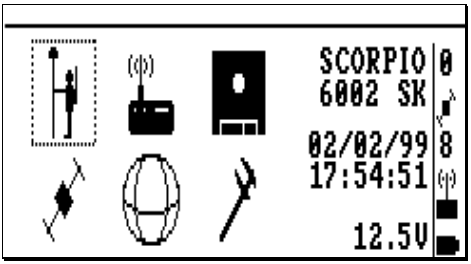
Keys and menus

A few keys and menu types need to be known for best use of the Palmtop Software program.

- **Main menu screen**

  The main menu shows the 6 groups of functions available in the form of icons (see below).

1 2 3

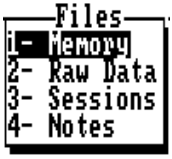


4 5 6

  Use the vertical- or horizontal-arrow keys (↑, ↓, →, ←) to select an icon. The selected icon is surrounded by dotted lines. Then press ↵ to enter the corresponding function. Alternately, you can directly enter a function by pressing the corresponding numeral key (see figures 1 to 6 in the screen example above)

- **Function menus**

  They are displayed after selecting an icon in the main menu and pressing ↵. Function menu example:



1
2
3
4

  - Using the vertical-arrow keys, select a function in the menu and then press ↵ again to run this function
  - Alternately, you can directly run a function by pressing the corresponding numeral key (se figures in the screen example above).
  - You can directly go from the Function menu of an icon to that of the next or previous one by pressing → or ←.

NOTE: The first icon is inactive.

- **Help menus**

  There is a **Help** menu specific to almost each function, listing all the commands available in the context of this function.

  To display the **Help** menu, press the **F1** key. This causes the **Help** menu to be superimposed on the screen. Then do the following:

  - Press the key-letter to run the desired command.
  - or simply press the **Esc** key if you do not want to run any command. Incidentally, this will remove the Help menu from the screen

  For example, and as shown on the **Help** menu below, pressing the "↵" key will let you define the start and end times of the selected session line:

NOTE: You cannot view any **Help** menu while editing a parameter.

D

- **Other important keys**

  Shift+F1

  - From anywhere in the program, pressing **Shift+F1** will allow you to access the palmtop's notepad (see page *D-22*)

  Esc

  - Pressing the **Esc** key will take you back to the preceding screen, or will remove the **Help** menu from the screen, or will cancel the change you make to a parameter, or after the auto-test, will allow you to switch from the **antenna height** screen (which automatically appears at the end of the auto-test) to the **main menu** screen.

  F4

  - Pressing the **F4** key will allow you to quit the program. Confirm this choice by pressing ↵ (or press **Del** to cancel the request). Then a message is displayed asking you whether, in the same time, the receiver should be turned off (press the **Del** key) or not (press ↵).

- **Making changes to parameters**

  Depending on the size and type of the parameters that can be changed, the program will use different scenarios to let you make that change:

  - If the screen contains numerical or alpha-numerical parameters, a blinking cursor will appear on the first of them.

To change this parameter, simply type in the new value. Note that the position of the field on the screen will be shifted to the left while you edit it. If the size of the parameter is relatively long, an edit box will appear on top of the screen to show the entire field while you edit it.

In both cases, the new value will be validated after you press ↵. Use ↓ or ↑ to access the next or previous field (respectively).

- If a parameter can only be set to some specific software-set values, then this field will be marked with a "▶". To know the possible values and choose one of them, use ↓ or ↑ to access this field and then press →. A select box appears showing these values. Use ↓ or ↑ to choose the desired value and press ↵ to validate your choice (the select box is removed from the screen at the same time). Alternately, you can directly type the numeral key corresponding to the row in which the desired value is shown (same as function menus, see page *D-2*).

D

- **Messages and alarms:**
  - The buzzer will beep in the following cases:
    - At the end of every auto-test
    - In case of invalid data entry or display request or other errors
  - Low battery alarm:
    - A beep will be heard and the "Battery is low" message will appear
    - Battery icon in the status area will blink until you change the battery

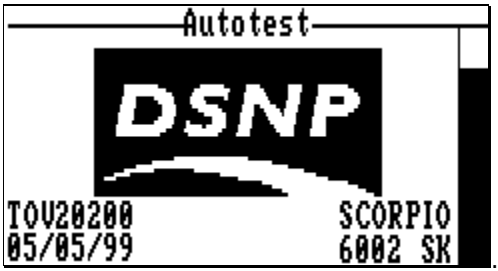
- Satellite alarm:
  - Satellite icon in the status area will blink until 4 SVs or more can be received

- Communications problem with receiver:
  - A beep will be heard and the "Receiver not responding" message will appear

Getting started

Assuming the base station is now ready and you have the palmtop in hand, do the following:

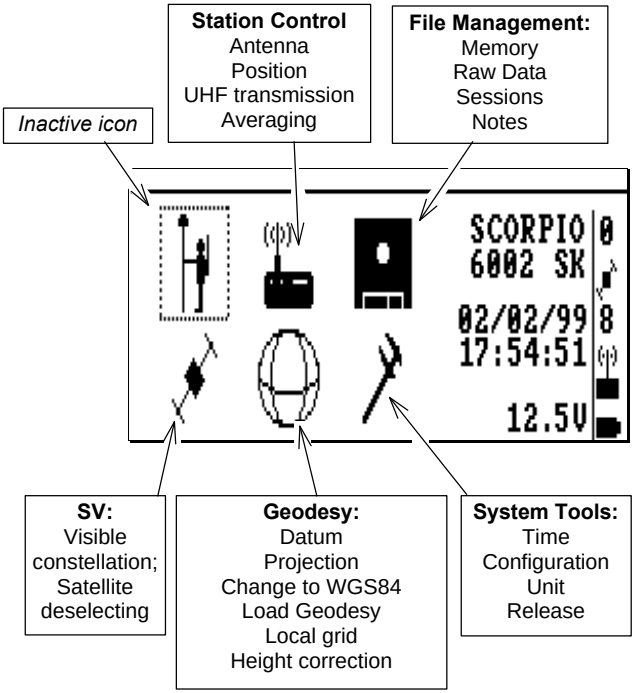
- From the DOS prompt, type in "T" or “t” and press ↵. The following screen appears denoting auto-tests in progress:



...

At the end of the auto-tests, the antenna height screen automatically appears. This is to suggest you not to forget to enter this very important parameter (this screen is described in page *D-8*).

Then press the **Esc** key to access the main menu.



- Use the vertical- or horizontal-arrow keys (↑, ↓, →, ←) to select an icon. The selected icon is surrounded by dotted lines.
- Press ↵ to validate your selection (or press the corresponding numeral key as a shortcut).

Station Control

- From the main menu, select :
- Press ↵. The following function menu then appears:

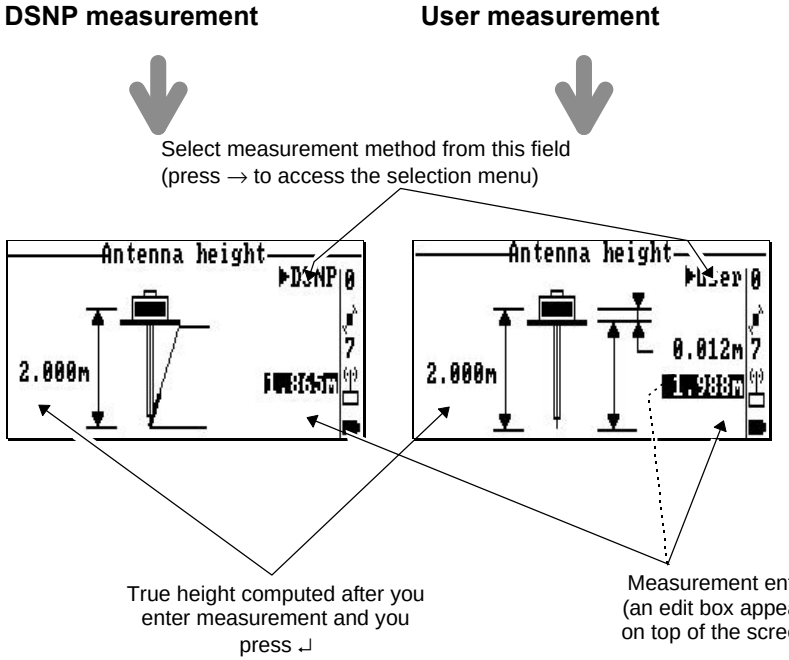
Each of these functions is described below.

Antenna

This function allows you to enter the measurement you have made after installing the GPS antenna in the field.

From this value, the program will determine the true height of this antenna with respect to the ground.

After choosing this function, press the ← key to access the field from which you can select the type of measurement made (see *section 3*) and then enter the measurement as explained in the screens which follow.



D

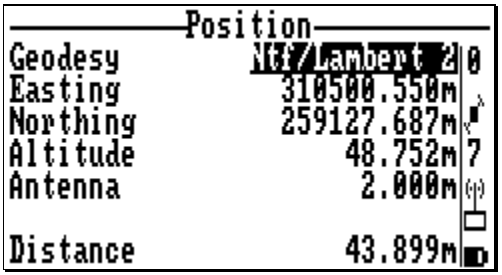
Position

This function allows you to enter the position of the station. There are three ways of entering this position:

1. by typing in successively each of its coordinates in the dedicated fields (see screen example on next page). Then press ↵ to validate this position.

   If the position is not accurately known, enter an estimate of each of the coordinates and then let the receiver run in the *Average Position mode* for some time to allow it to refine this position (see page *D-13*).

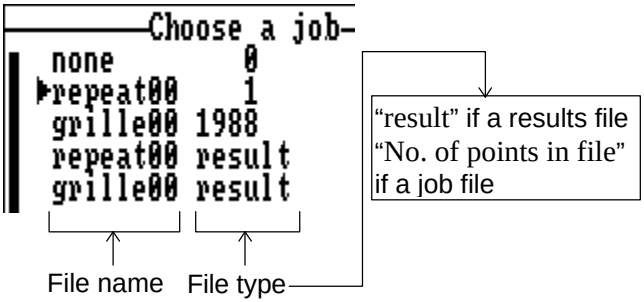
2. by loading it from a PCMCIA containing a job (see procedure below)
3. by transferring the solution available after running in *Average Position mode* as the new position of the station.



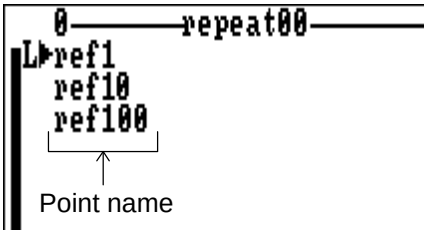
On the **position** screen (see example above), the name of the coordinate system used (top of the screen) and the height of the GPS antenna (bottom of the screen) are just displayed for your information. The coordinate system is the one defined using the **Geodesy** function (see page *D-27*), and the antenna height is the one defined using the **Antenna** function (see page *D-8*).

The “Distance” parameter displayed at the foot of the screen stands for the deviation between the reference position you have just entered and the position solution computed in straight GPS by the station. This information allows you to make sure the entered position is not aberrant: you can conclude from a “Distance” reading not exceeding about a hundred meters that the position entry is correct.

- **Loading the station position from a PCMCIA**
  - Insert the PCMCIA into the card reader
  - Select the **Position** function
  - Press the **F** key. This displays the list of jobs present on the PCMCIA:



- Select a file (a job file or a result file) and press →. A new screen appears showing the names of the points present in the file. If a job file is selected, two types of points may be selected: target points and reference points.

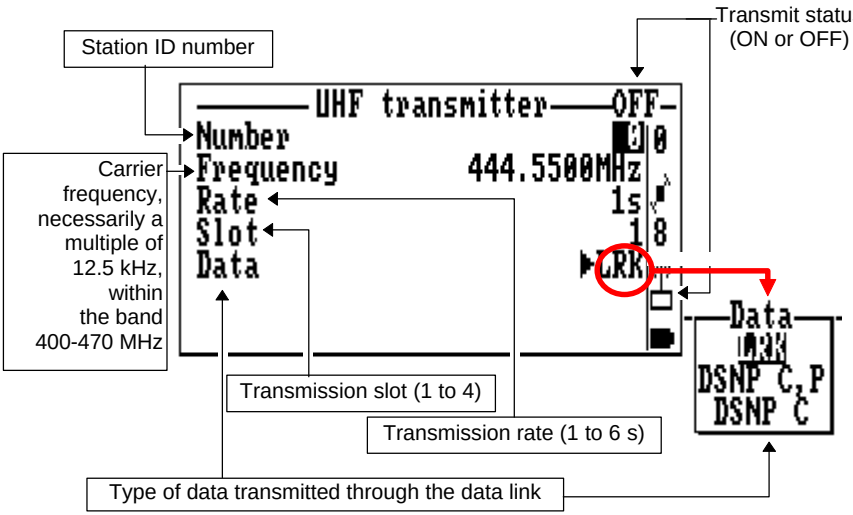


- Select a point and press →. This loads the coordinates of this point to the receiver as the position of the station. In the same time, the coordinate system (geodesy) defined for the job is also loaded to the receiver.

D

Transmitter

This function allows you to program the UHF transmitter and enable /disable UHF transmission.



Associated **Help** menu:

(displayed by pressing **F1**, removed by pressing **Esc**)

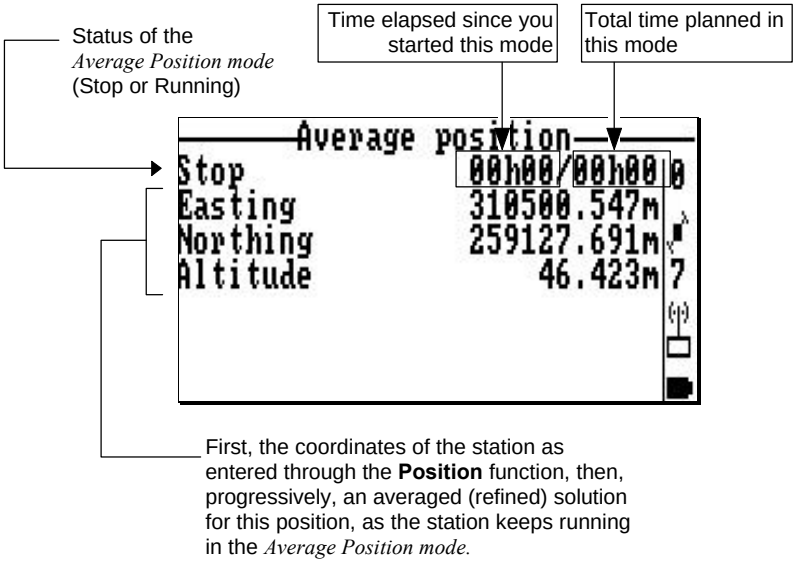
According to context:

- Press the **E** key to enable transmission at the station.
- or press the **S** key to disable transmission

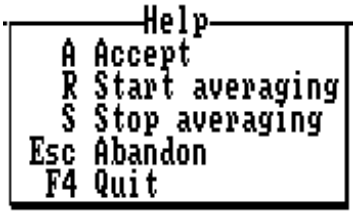
Average position

This function allows you to program the *Average Position mode* and enable/disable this mode.

Operating the base station in this mode makes it possible to refine its location if the coordinates you entered through the **Position** function (see page *D-9*) are just an estimate.



Associated **Help** menu:



(displayed by pressing **F1**, removed by pressing **Esc**)

According to context:

- Press the **R** key to enable the *Average Position mode*. In the edit box which then appears, enter the time (hh:mm) during which you want the station to operate in this mode:

where hh: hours and mm: minutes

Choose this time according to the figures given in the table below.

Operating time in *Average Position mode*	**Resulting uncertainty on station's coordinates**
10 min	50 meters
30 min	30 meters
1 hour	20 meters
12 hours	5 to 10 meters
24 hours	< 5 meters

At the end of this planned time, the status will switch to “STOP”.

- or press the **S** key to stop operating in this mode, thus causing the status to be changed to “STOP”
- or press the **A** key to transfer the displayed position as the new valid position of the station (this position will then appear on the screen of the **Position** function; see page *D-9*).

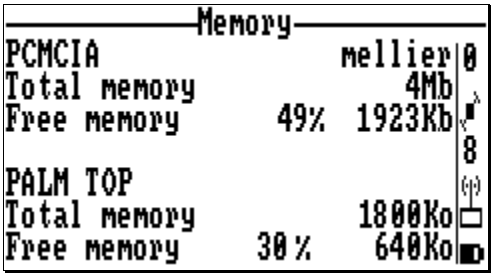
NOTE: Access to this function is denied if UHF transmission is active.

File Management

- From the main menu, select the third icon:
- Press ↵. The following function menu then appears:

Memory

This function indicates the amount of free memory still available on the inserted PCMCIA and on the palmtop.

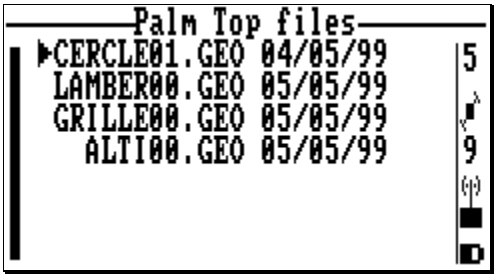


Associated **Help** menu:

(Displayed by pressing **F1**, removed by pressing **Esc**)

- Pressing the **F** key lists all the *.geo files (geodesy description files) stored in the palmtop.

Screen example showing a list of *.geo files:



Associated **Help** menu:

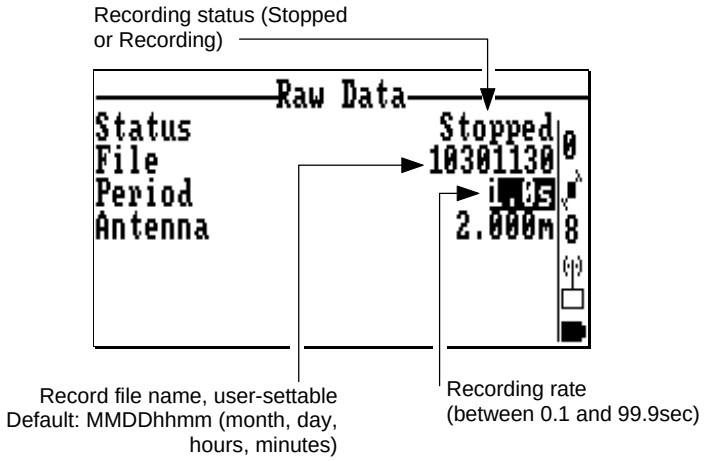
(Displayed by pressing **F1**, removed by pressing **Esc**)

According to context:

- Press the **Del** key to delete the selected file
- Press the **Clr** key to delete all the *.geo files stored in the palmtop (i.e. all the listed files).

Raw Data

This function allows you to perform immediate recording of GPS raw data.



Associated **Help** menu:

According to context:

- Press the **R** key to start recording raw data on the PCMCIA.
- or press the **S** key to stop recording. As a result, the record file will be closed, thereby making the system ready for the next data recording.

Sessions

This function allows you to plan operating sessions for the base station.

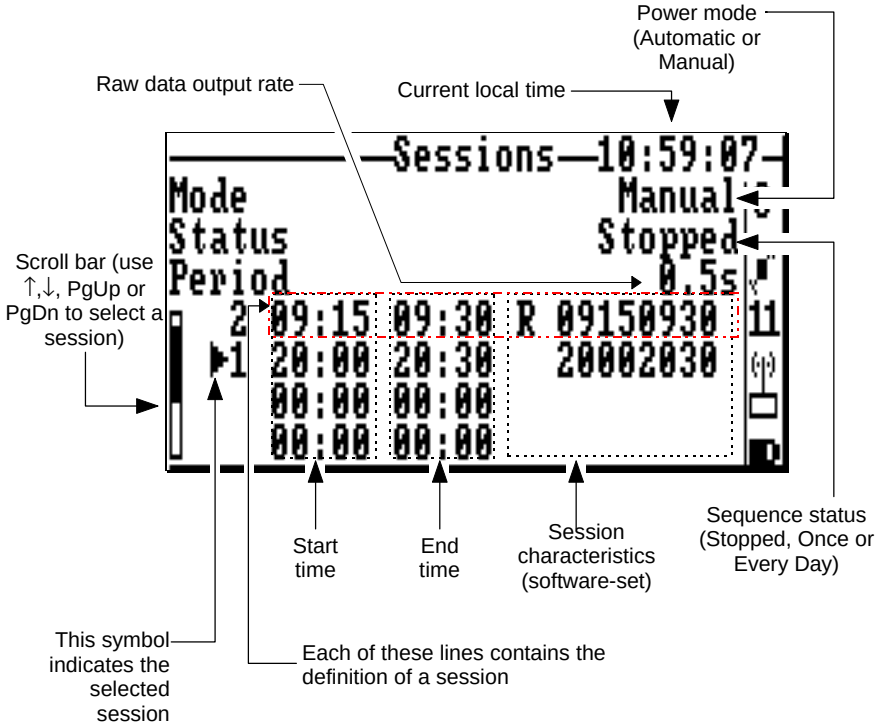
A session is an interval of time during which you wish the station to operate, combined with the possibility of having raw data recorded on the PCMCIA card.

The two underlying operating aspects of a session are the following:

- Through a session, you can ask the station to switch on and off automatically at planned times (on a daily basis or not), thus allowing you to save energy from your batteries (this operating mode requires that you choose the **Automatic** power mode).
- Through a session, you can ask the station to perform data recording on PCMCIA during the session. Making recordings at a station may be a requirement tied to the surveying method used.

Before doing anything about sessions, please read the following :

- If you do nothing with sessions, then the station will operate on a permanent basis, with no recording on the PCMCIA, until you turn it off manually.
- Changes can be made on sessions only if the sequence of sessions has been disabled.



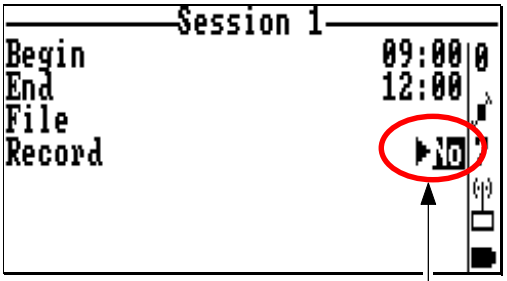
Associated **Help** menus:

According to context:

- Press the **R** key to run the sequence of sessions, and then specify whether the sequence must be executed once or every day:

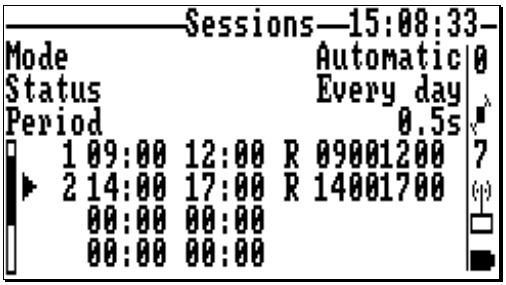
- Press the **S** key to stop the sequence of sessions.
- Press the **A** key to switch the station to **Automatic** power mode
- Press the **M** key to switch the station to **Manual** power mode.
- Press the **P** key to change the raw data output rate
- After placing the pointer in a session line, press a numeral key (**1** to **8**) to assign a run-time number to this session. For example, if you press “2”, the session will be executed in second position within the sequence. Not assigning a number to a session line will result in the non-execution of the session
- Conversely, after placing the pointer in a session line, press the **Del** key to remove the session from the sequence (the session will no longer be executed).
- After selecting a session from the displayed list, press ↵ to edit its characteristics.

Example of screen obtained when editing the characteristics of a session:



From this field, specify whether raw data must be recorded (Yes) or not (No) during the session (press → to access the selection menu.

Example of screen obtained while a sequence of sessions is being executed (typical sequence in which two sessions are run every day from 9:00 to 12:00 am and from 2:00 to 5:00 pm):



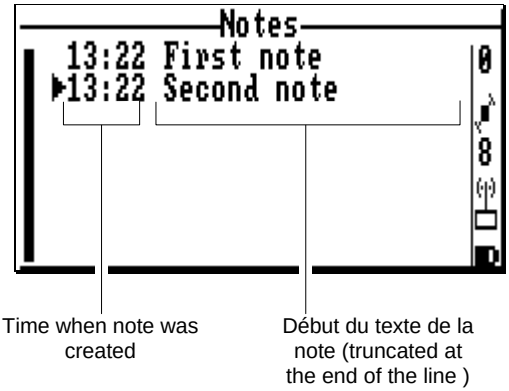
Notes

This function allows you to access the notepad. The notepad is a text file associated with the palmtop. This file consists of one or more notes which the operator creates when needed. Whenever the operator creates a note, this new note is placed after the previously created one, at the end of the file. The format of each note is the following:

1: Date
2: Time
3: Name of the job in progress
4: Note as such (text), 150 characters max. in length.

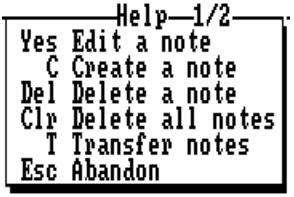
Accessing the notepad is simply obtained by the key combination **Shift+F1** from anywhere in the program.

After you press **Shift+F1**, the palmtop displays the list of the notes present in the notepad. In the example below, two notes are listed:



Associated **Help** menu:

(Displayed by pressing **F1**, removed by pressing **Esc**)



According to context:

- After selecting a note in the list, press the **Yes** key to edit the content of the note. This command allows you to make changes to the content of a note.
- Press the **C** key to create a new note and write into it
- After selecting a note in the list, press the **Del** key to delete this note
- Press the **Clr** key to delete all the notes
- Press the **T** key to transfer the notepad file (hence all the notes) to the PCMCIA. First you must specify the name of the file which will be created on the PCMCIA:

  (File name in this example: note)

  The extension of the file created on PCMCIA for the notepad is necessarily “txt”.

D

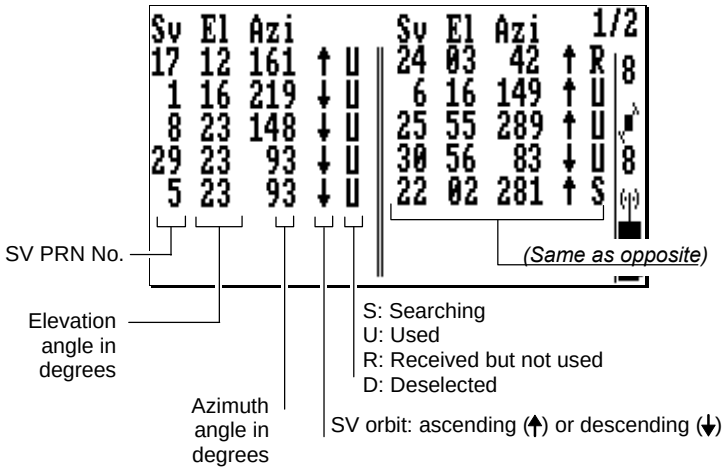
SVs

- From the main menu, select the fourth icon:
- Press ↵. The following function menu then appears:

Visible Constellation

This function gives information about the GPS constellation visible from the base station. The information is arranged in two screens (1/2 and 2/2). Within the function, use the **PgUp** and **PgDn** keys to change screen.

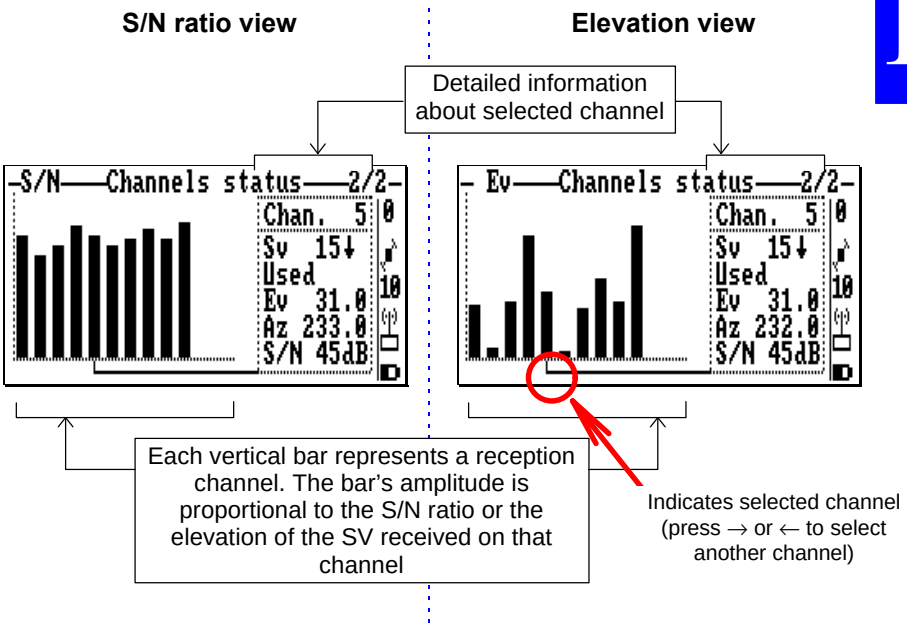
Screen 1/2 example:



Screen 2/2 contains graphical and alpha-numerical information about the constellation.

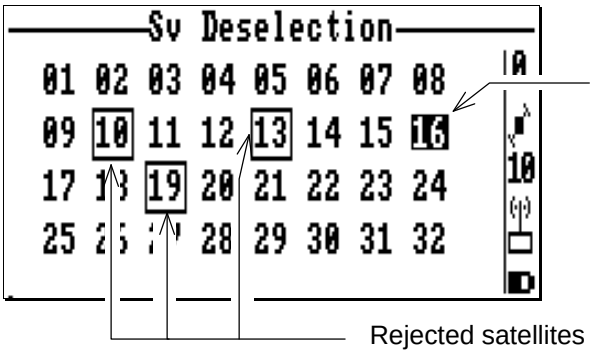
Help menu associated with screen 2/2:

- Press the **N** key to define the number of channels represented on the bar graph (typically 16 or 12)
- Press the **P** key to select which bar graph to show on the screen (either S/N Ratio or Elevation view):
- Use the horizontal-arrow keys to display complete information for the desired channel.



Deselection

This function allows you to reject one or more GPS satellites from the position processing performed at the station.



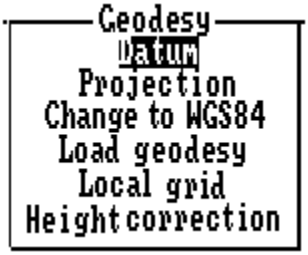
Associated **Help** menu:

According to context:

- Use the arrow keys to select the PRN of the SV you want to reject or re-select
- Press the **Del** key to reject or re-select the highlighted SV
- Press the **Yes** key to validate all the changes made to the PRN table

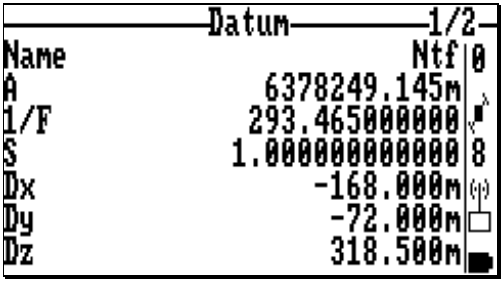
Coordinate System Used

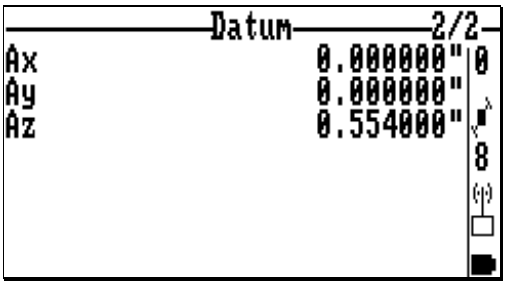
- From the main menu, select the fifth icon:
- Press ↵. The following function menu then appears:



Datum

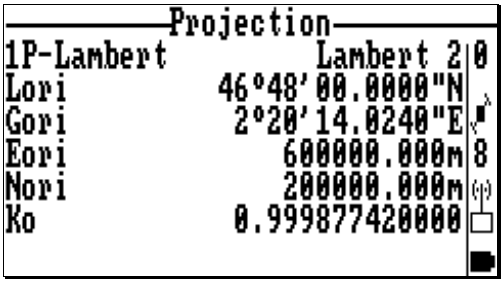
This function gives the characteristics of the datum used. As shown in the example below, this information is presented on two screens. Use the **PgUp** and **PgDn** keys to change screen.





Projection

This function gives the characteristics of the projection used (see example below).



Change to WGS84

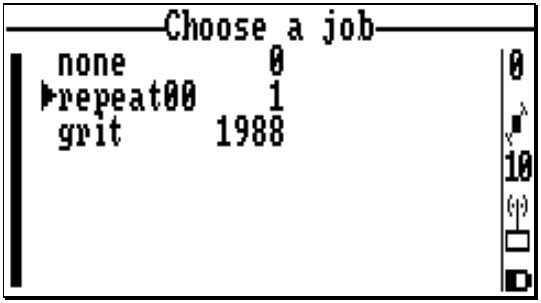
This function allows you to choose the WGS84 as the new system used by the receiver. User confirmation is required before the receiver switches to this system.

Load Geodesy

This function allows you to transfer the geodesy (coordinate system) defined for a job to the base station.

- After inserting the PCMCIA into the GNSS receiver of the base station, select the **Load Geodesy** function. The names of the jobs read from the PCMCIA appear on the screen.

  Example:

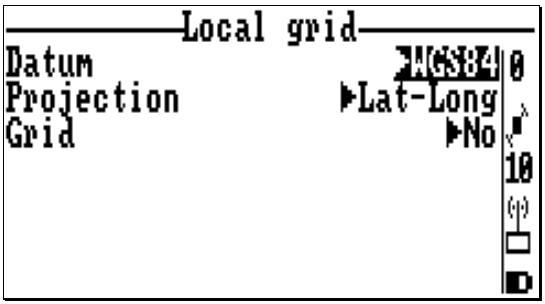


- Choose one and press ↵. This causes the selected coordinate system to be instantaneously loaded from the PCMCIA to the base station
- Press the **Esc** key to leave the function.

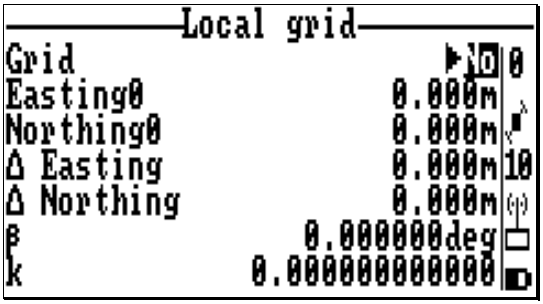
Local Grid

This function allows you to view the local grid used, if any. When selecting the function, the datum and projection currently used are recalled on the screen which then appears. From this screen, you can access the **Datum** and **Projection** functions described in the preceding pages.

Screen example:



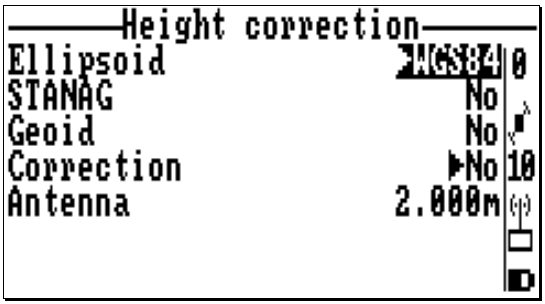
- Select the Grid field (third line) and press →. A new screen appears viewing the local grid:



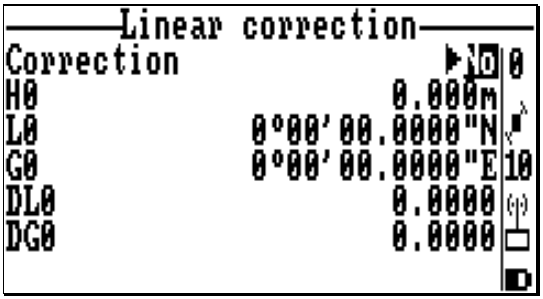
Height correction

This function allows you to view the vertical system used. When selecting this function, the ellipsoid and antenna altitude are recalled on the screen which then appears.

Screen example:



- To view the height correction, select the Correction field and then press →. A new screen appears viewing the height correction:



D

System Tools

- From the main menu, select the fifth icon:
- Press ↵. The following function menu then appears:

```
Tools
1- Time
2- Configuration
3- Unit
4- Release
```

Time

This function allows you to read/change the local time.

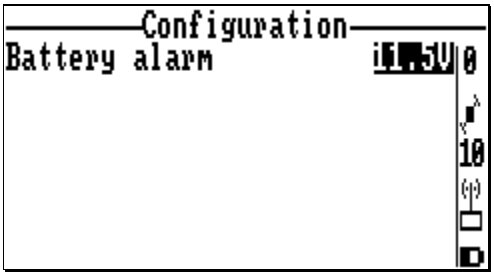
```
Time & Date

Offset              8:00
Local time         16:08:31
Date               20/07/98

UTC time           08:08:31
```

- Press **F1** to display the Help menu. Use the key-letters shown in this menu to change the time & date.

```
Help
  O Set offset
  T Set time
  D Set date
Esc Abandon
 F4 Quit
```

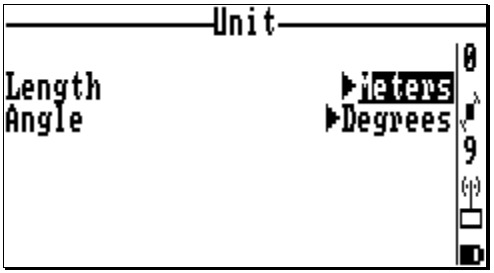
Configuration

This function allows you to define the lower operating limit of battery voltage.



Unit

This function allows you to choose the units used to express angles and distances.



Release

This function gives information about the versions and revisions of the hardware elements composing the system.

♣

E. Notation rules used in SVAR and SBIN formats

SVAR

Reserved characters

	(02h)	<stx>	Beginning of message
!	(21h)		Format indicator
,	(2Ch)		Field delimiter
@	(40h)		Checksum delimiter
.	(2Eh)		Decimal separator
"	(22h)		Beginning and end of label
	(0Dh,0Ah)	<eoln>	End of line
	(03h)	<etx>	End of message

Subscript letter h at the end of a character string means that this string is in hexadecimal notation.

Conventions used

field	Generic term representing one or more data
data	Numerical value or label
< >	Surrounds a field name
<stx>	Beginning of message (02h)
<sobk>	Beginning of block: one or more characters, identifies beginning of block
<soln>	Beginning of line: one or more characters, identifies beginning of line in a block
<eoln>	End of line, 2 characters: CR,LF (0Dh 0Ah)
<etx>	End of message (03_h)

The term "block" stands for a group of data of the same nature.

The term "numerical value" encompasses all types of possible encodings : binary, decimal, hexadecimal.

The term "number" used without any further indication stands for a decimal number (base 10).

The term "label" stands for an ASCII character string.

General form

<stx> <eoln>
<sobk> <,> < time tagging line > <eoln>
<soln> <,> < 1st data line > <eoln>
...
<soln> <,> < n^{th} data line > <eoln>
<etx>

The count and type of data in any given line are predefined, which means that the count of separators <,> is invariable.

Any data missing or replaced by one or more spaces means that this data is not available.

Rule about numerals

A "zero" value is assumed to be valid. Spaces placed before or after numerals are not significant. There cannot be spaces within a numeral.

The following formats are usable:

decimal : decimal separator is the "." symbol. It is always preceded by at least one figure (.25 is written 0.25) and followed by at least one figure, otherwise the integer notation is used.

integer : particular case of decimal notation without separator.

floating : exponent character is 'E' (example : 6.2512E3 = 6251.2)

signed : signs are placed at the beginning of the mantissa and after the exponent character. A numeral with no sign is assumed to be positive. There cannot be spaces between the sign and the first figure.

Rule about labels

Labels are denoted by <"> characters surrounding them. They can take any ASCII value except <">, <stx> and <etx>.

Labels can optionally be associated with a numeral. In this case:

- They are placed just before or after the <,> field delimiter
- They are separated from the numeral by a <space> character

Error check rule

An optional checksum can be placed at the end of every line (except for the <stx> and<etx> lines), between the last data in the line and <eoln>. The presence of the checksum is denoted by the @ character followed by the two end-of-line characters.

The checksum results from exclusive-OR gating all the characters in the line, excluding the @ character. The resulting 8-bit checksum is converted into 2×4 bits in hexadecimal notation and then the two half-bytes are ASCII-encoded. The most significant character is transferred first.

SBIN

Reserved characters

By principle, all possible binary values in a byte are allowed. However three ASCII characters are used for message identification:

ASCII byte **FE_h** : denotes beginning of binary block

ASCII byte **FF_h** : denotes end of binary block

ASCII byte **FD_h** : denotes intentionally altered character

If between the beginning and the end of a block, the binary string initially includes such characters, then the following modifications are made to the string to avoid misinterpretation of the data at a further stage :

FD_h is converted into **FD_h 00_h**

FE_h is converted into **FD_h 01_h**

FF_h is converted into **FD_h 02_h**

NOTE : When counting bytes in a message, remember that all the "doubled" characters (i.e. FD_h 00_h FD_h 01_h and FD_h 02_h) resulting from the transcoding described above must be counted as single characters.

Conventions used

- The term "field" stands for one or more parameters.
- The term "data" stands for a binary value occupying a byte.
- In a byte, bit "**0**" stands for the least significant bit, bit "**7**" for the most significant bit. The most significant bit is always placed ahead.

Symbols used

< > : denotes a field

<stb> : beginning of block : ASCII character **FE_h**

<blid> : block type: 1 ASCII character allowing identification of the data type

<long> : 2 bytes in binary notation specifying the count of bytes in the block, from <stb> excluded up to <checksum> excluded

<checksum> : 2 bytes (for transmission error check)

<etb> : end of block: ASCII character **FF_h**

General form

<stb> : 1 byte (FE_h)

<blid> : 1 byte

<long> : 2 bytes

<data> : 1 to 1023 bytes

<checksum> : 2 bytes

<etb> : 1 byte (FE_h)

The meaning of the data in each block type is predefined

Error check rule

The message content is checked for transmission error through two "checksum" bytes the values of which result from the sum of all bytes, modulo 2^{16}, from <stb> excluded to <checksum> excluded.

Rule about numerals

Unless otherwise specified:

- Numerals are expressed in binary, with fixed decimal point
- The notation of signed numbers meets the rule of the 2' s complement.

♣

F. GPS Raw Data in SBIN format

SBIN@R : Single-frequency GPS pseudoranges in satellite time

- **General form**

<stb><**R**>	2 bytes
<long>	2 bytes
<time tagging>	5 bytes
<parameters>	1 byte
<Raw Data, 1stSV>	14 bytes
...	
<Raw Data, last SV>	14 bytes
<checksum>	2 bytes
<etb>	1 byte

- **Time tagging**

First 2 bytes : GPS week number (assuming the modulo 2^{10} ambiguity is removed)

Last 3 bytes : GPS time in week (unit: 1/10 s). The reference time is jan 6 1980 at 0hr00.

- **Parameters**

A single byte:

Bits 0 and 1 : Code smoothed by carrier according to RTCM message No. 19

Code	Smoothing Interval
00	0 to 1 minute
01	1 to 5 minutes
10	5 to 15 minutes
11	Indefinite

Bit 2 =1

Bit 3 : =0

Bits 4 to 6 : (*reserved*)

Bit 7 : =0 (single-frequency measurements)

- **Satellite Raw Data**

1st byte : SV number

Next 4 bytes : C/A code pseudorange (unit=10^{-10} s; modulo 400 ms)

Next byte : bits 0 to 4: Level indicator
(C/No-26 dB.Hz)
bits 5 to 6 not used
bit 7=1 if phase measurement not valid

Next 3 bytes : $L1_{C/A}$ carrier phase (unit: 10^{-3} cycle, modulo 10^4 cycles)

Next 3 bytes : $L1_{C/A}$ carrier phase (unit 4×10^{-3} cycle/s, field ~ 32 Hz; MSB=sign;
800000_h=measurement not valid)

Next byte : $L1_{C/A}$ carrier quality indicator
Bits 0 to 4: "cumulative loss of continuity indicator", complies with RTCM message No. 18, counter modulo 32 incremented every time the continuity of the carrier phase measurement is lost

Bits 5 to 7: "data quality indicator", complies with RTCM message No. 18

"000": phase error ≤ 0.00391 cycle
"001": phase error ≤ 0.00696 cycle
"010": phase error ≤ 0.01239 cycle
"011": phase error ≤ 0.02208 cycle
"100": phase error ≤ 0.03933 cycle
"101": phase error ≤ 0.07006 cycle
"110": phase error ≤ 0.12480 cycle
"111": phase error > 0.12480 cycle

Last byte : C/A code quality indicator

Bits 0 to 3: "pseudorange multipath error indicator", complies with RTCM message No. 19
"1111": multipath error not determined

Bits 4 to 7: "pseudorange data quality indicator", complies with RTCM message No. 19

"0000": pseudorange error ≤ 0.020
"0001": pseudorange error ≤ 0.030
"0010": pseudorange error ≤ 0.045
"0011": pseudorange error ≤ 0.066
"0100": pseudorange error ≤ 0.099
"0101": pseudorange error ≤ 0.148
"0110": pseudorange error ≤ 0.220
"0111": pseudorange error > 0.329
"1000": pseudorange error ≤ 0.491
"1001": pseudorange error ≤ 0.732
"1010": pseudorange error ≤ 1.092
"1011": pseudorange error ≤ 1.629
"1100": pseudorange error ≤ 2.430
"1101": pseudorange error ≤ 3.625
"1110": pseudorange error ≤ 5.409
"1111": pseudorange error > 5.409

SBIN@R : Dual-frequency GPS pseudoranges in satellite time

- **General form**

<stb><**R**>	2 bytes
<long>	2 bytes
<time tagging>	5 bytes
<parameters>	1 byte
<Raw Data, 1stSV>	14 bytes
...	
<Raw Data, last SV>	14 bytes
<checksum>	2 bytes
<etb>	1 byte

- **Time tagging**

First 2 bytes : GPS week number (assuming the modulo 2^{10} ambiguity is removed)

Last 3 bytes : GPS time in week (unit: 1/10 s). The reference time is jan 6 1980 at 0hr00.

- **Parameters**

A single byte:

bits 0 and 1 : C/A code smoothed by carrier, complies with RTCM message No. 19

Code	Smoothing Interval
00	0 to 1 minute
01	1 to 5 minutes
10	5 to 15 minutes
11	Indefinite

Bit 2=Bit 3 : =1

Bits 4 to 6 : =0 (*reserved*)

Bit 7 : =1 (dual-frequency measurements)

- **Satellite Raw Data**

1st byte : SV number

Next 4 bytes : C/A code pseudorange (unit: 10^{-10} s modulo:0.4 s)

Next byte : bits 0 to 4: Level indicator (C/No – 26), in dB.Hz

bits 5, 6 and 7: channel status

bit 5=0 if P code; =1 if Y code

bit 6=1 if $L2_{P/Y}$ phase measurement not valid

bit 7=1 if $L1_{C/A}$ phase measurement not valid

Next 3 bytes : $L1_{C/A}$ carrier phase (unit=10^{-3} cycle, modulo 10^4 cycles)

Next 3 bytes : $L1_{C/A}$ carrier phase (unit=4×10^{-3} cycles/s; field~32 kHz; MSB=sign;

800000_h=measurement not valid)

Next byte : $L1_{C/A}$ carrier quality indicator

Bits 0 to 4: "cumulative loss of continuity indicator", complies with RTCM message No. 18, counter modulo 32 incremented every time the continuity of the carrier phase measurement is lost

Bits 5 to 7: "data quality indicator", complies with RTCM message No. 18

"000": phase error ≤ 0.00391 cycle
"001": phase error ≤ 0.00696 cycle
"010": phase error ≤ 0.01239 cycle
"011": phase error ≤ 0.02208 cycle
"100": phase error ≤ 0.03933 cycle
"101": phase error ≤ 0.07006 cycle
"110": phase error ≤ 0.12480 cycle
"111": phase error > 0.12480 cycle

Next byte : C/A code quality indicator

Bits 0 to 3: "pseudorange multipath error indicator", complies with RTCM message No. 19
"1111": multipath error not determined

Bits 4 to 7: "pseudorange data quality indicator", complies with RTCM message No. 19

"0000": pseudorange error ≤ 0.020
"0001": pseudorange error ≤ 0.030
"0010": pseudorange error ≤ 0.045
"0011": pseudorange error ≤ 0.066
"0100": pseudorange error ≤ 0.099
"0101": pseudorange error ≤ 0.148
"0110": pseudorange error ≤ 0.220
"0111": pseudorange error > 0.329
"1000": pseudorange error ≤ 0.491
"1001": pseudorange error ≤ 0.732
"1010": pseudorange error ≤ 1.092
"1011": pseudorange error ≤ 1.629
"1100": pseudorange error ≤ 2.430
"1101": pseudorange error ≤ 3.625
"1110": pseudorange error ≤ 5.409
"1111": pseudorange error > 5.409

Next byte : $L1_{P/Y} - L1_{C/A}$ carrier phase deviation, centered around zero (unit=1/256th cycle; MSB=sign; 80_h=measurement not valid)

Next 2 bytes : $P_{L1} - C/A_{L1}$ code deviation (unit=10^{-10} s; field~3.2 µs; MSB=sign; 8000_h=measurement not valid)

Next 2 bytes : $P_{L2} - C/A_{L1}$ code deviation (unit=10^{-10} s; field~3.2 µs; MSB=sign; 8000_h=measurement not valid)

Next 3 bytes : $L2_{P/Y}$ carrier phase (unit=10^{-3} cycles modulo 10^4 cycles of L2)

Next 3 bytes : $L2_{P/Y}$ carrier speed (unit=4×10^{-3} cycles/s; field~32 kHz; MSB=sign; 800000_h=measurement not valid)

Next byte : L2 carrier quality indicator

Bits 0 to 4: "cumulative loss of continuity indicator", complies with RTCM message No. 18, counter modulo 32 incremented every time the continuity of the carrier phase measurement is lost

Bits 5 to 7: "data quality indicator", complies with RTCM message No. 18

"000": phase error ≤ 0.00391 cycle
"001": phase error ≤ 0.00696 cycle
"010": phase error ≤ 0.01239 cycle
"011": phase error ≤ 0.02208 cycle
"100": phase error ≤ 0.03933 cycle
"101": phase error ≤ 0.07006 cycle
"110": phase error ≤ 0.12480 cycle
"111": phase error > 0.12480 cycle

F

Last byte : P/Y code quality indicator

Bits 0 to 3: "pseudorange multipath error indicator", complies with RTCM message No. 19
"1111": multipath error not determined

Bits 4 to 7: "pseudorange data quality indicator", complies with RTCM message No. 19

"0000": pseudorange error ≤ 0.020
"0001": pseudorange error ≤ 0.030
"0010": pseudorange error ≤ 0.045
"0011": pseudorange error ≤ 0.066
"0100": pseudorange error ≤ 0.099
"0101": pseudorange error ≤ 0.148
"0110": pseudorange error ≤ 0.220
"0111": pseudorange error > 0.329
"1000": pseudorange error ≤ 0.491
"1001": pseudorange error ≤ 0.732
"1010": pseudorange error ≤ 1.092
"1011": pseudorange error ≤ 1.629
"1100": pseudorange error ≤ 2.430
"1101": pseudorange error ≤ 3.625
"1110": pseudorange error ≤ 5.409
"1111": pseudorange error > 5.409

SBIN@A: Almanac data

- **General form**

<stb><**A**>	2 bytes
<long>	2 bytes
<almanac ident.>	3 bytes
<SV almanac>	24 bytes
<checksum>	2 bytes
<etb>	1 byte

- **Almanac identification**

First byte : Number of the GPS satellite corresponding to the transmitted almanac (binary)

Last 2 bytes : Almanac *reference* week number (modulo 2^{10} ambiguity removed)

- **Almanac data**
  - Bits 1 to 24 from words 3 to 10 in subframes 4 or 5 (depending on SV number)

F

SBIN@E: Ephemeris data

- **General form**

<stb><**E**>	2 bytes
<long>	2 bytes
<ephemeris ident.>	1 byte
<SV almanac>	24 bytes
<words 3 to 10, subfr 1>	24 bytes
<words 3 to 10, subfr 2>	24 bytes
<words 3 to 10, subfr 3>	24 bytes
<checksum>	2 bytes
<etb>	1 byte

- **Ephemeris identification**

  A single byte : Number of the GPS satellite corresponding to the transmitted ephemeris (binary)

- **Ephemeris data**
  - Bits 1 to 24 from words 3 to 10 in subframe 1
  - Bits 1 to 24 from words 3 to 10 in subframe 2
  - Bits 1 to 24 from words 3 to 10 in subframe 3

SBIN@U: Iono/UTC data

- **General form**

<stb><**U**>	2 bytes
<long>	2 bytes
<Iono/UTC data>	24 bytes
<checksum>	2 bytes
<etb>	1 byte

- **Iono/UTC Data**
  - Bits 1 to 24 from words 3 to 10 in subframe 4, page 18, declared valid by the GPS sensor

SBIN@S: Health & A/S data

- **General form**

<stb><**S**>	2 bytes
<long>	2 bytes
<A/S & Health data>	24 bytes
<Health data>	24 bytes
<checksum>	2 bytes
<etb>	1 byte

- **Health & A/S Data**

A/S & Health : Bits 1 to 24 from words 3 to 10 in subframe 4, page 25, declared valid by the GPS sensor

Health : Bits 1 to 24 from words 3 to 10 in subframe 5, page 25, declared valid by the GPS sensor

♣

F

G. Results files in ASCII SVAR format

File Header

< stx ><eoln>
!L,<GPS week><GPS time><eoln>
*1,<label11>,<label12>,<label13><eoln>
*2,<label21>,<label22><eoln>

!L line

<GPS week> GPS week number

<GPS time> GPS time in week, in seconds (Reference time is Jan 6 1980 at 0hr00)

*1 : Header line #1

< label11 > Time when file first opened (mm/mm/yyyy hh :mm :ss)

< label12 > Operator name (20 characters max.)

< label13 > Work area label (8 characters max.)

*2 : Header line #2

< label21 > File or Job name

< label22 > Comment (48 characters max.)

Points list

<stx><eoln>
!I,<GPS week>,<GPS time><eoln>
*1,<point type>,<point number>,<label11>,<label12>,
<label13>,<label14>,<label15>,<label16>,<label17> <eoln>
*2,<X >,<Y>,<Z>,<distance unit code>,<angle unit code><eoln>
*3,<X ECEF>,<YECEF>,<ZECEF>,<unit code><eoln>
*4,<value41>,<value42>,<value43>,<value44>,
<value45>,<value46>,<distance code><eoln>
∗6,<EL0>,<NL0>,<DE>,<DN>,<BETA>,<K>,<distance unit code>,<angle unit code><eoln>
∗9,<SDE>,<CEN>,<SDN>,<CEH>,<CNH>,<SDH>,
<MU>,<N>,<Q>,<unit code><eoln>
∗A,<Dif station number>,<XECEF>,<YECEF>, <ZECEF><eoln>
∗B,<Dif station number>,<XECEF>,<YECEF>, <ZECEF>< eoln >
∗C,<Dif station number>,<XECEF >,<YECEF>, <ZECEF>< eoln >
∗T, <XT>,<YT>,<ZT>,<point type>,<unit code><eoln>
<etx>

!I Time tagging line

<GPS week> GPS week number

<GPS time> GPS time in week, in seconds (Reference time is Jan 6 1980 at 0hr00)

!I: point identifier, character 49_{Hex} (GPS week and time are optional)

*1 : Point description line

<Point type>:

10:	reference point or staked-out reference point
11:	staked-out reference point, modified by operator
12:	staked-out reference point, through linear offset
13:	staked-out reference point, through lateral offset
20:	staked-out target point
21:	staked-out target point, modified by operator
22:	staked-out target point, through linear offset
23:	staked-out target point, through lateral offset
30:	logged point
31:	logged point, modified by operator
32:	logged point, through linear offset
33:	logged point, through lateral offset
34:	logged point, through intersection of lines
50:	logged point during trajectory work
51:	logged point during trajectory work, modified by operator
60 to 69:	Intermediate points involved in point offset procedure
70 to 79:	Points involved in the computation of grid parameters
80 to 89:	Points involved in the computation of altitude correction parameters

<point number>: recording number (software-set)

<label11>: point name (12 characters max.)
<label12>: geocode 1 (12 characters max.)
<label13>: geocode 2 (12 characters max.)
<label14>: geocode 3 (12 characters max.)
<label15>: geocode 4 (12 characters max.)
<label16>: comment (48 characters max.)
<label17>: recording local time ("26/11/97 18:51:59")

*2 : Line containing ground position in local coordinates

*3 : line containing ECEF position of antenna phase centre

This line contains the ECEF position of the antenna phase center when logging the point or the ECEF position of the antenna phase center in the case of an offset logged point.

*4 : Offset line

<value41>:	P1-to-P distance if point type is 12, 13, 22, 23, 32 or33
<value42>:	P2to-P distance if point type is 12, 13, 22, 23, 32 or33
<value43>:	Offset direction (1: to the right, –1: to the left) if point type is 13, 23 or 33
<value44>:	Not used
<value45>:	Not used
<value46>:	Antenna height

*6 : Deviations from user local grid

<EL0>:	Origin local easting
<NL0>:	Origin local Northing
<DE>:	Easting deviation
<DN>:	Northing deviation
<BETA>:	User local grid rotation angle
<K>:	Scale factor

*9 : Qualification line

<SDE>: Easting standard deviation

<CEN>: Easting/Northing correlation

<SDN>: Northing standard deviation

<CEH>: Easting/Height correlation

<CNH>: Northing/Height correlation

<SDH>: Height standard deviation

<MU>: Weighting factor standard deviation

<N>: Count of measurements involved in qualification processing

<Q>: Kind of position solution:

- 1: Natural
- 11: DGPS
- 21: EDGPS L1
- 31: KART R
- 41: KART A
- 51: EDGPS L1/L2
- 61: LRK R
- 71: LRK A
- 81: OFFSET

*A or B or C : line describing Differential station used

<Dif station No.>: identification number of a differential station involved in the position solution processing

<X ECEF><Y ECEF><Z ECEF>:

Coordinates of a differential station involved in the position solution processing

*T : line containing the planned position of a point to be staked out

<XT><YT><ZT>: planned ground position, in local coordinates, of a reference or target point.

<point type>:

1 for 1D

2 for 2D

3 for 3D

G

Kinematic re-initialization

(Output every time the receiver is re-initialized in real-time kinematic)

<stx ><eoln>
!**K**, <GPS week>,<GPS time><eoln>
∗1, <label11>,<value12>,<label13><eoln>
<etx>

!K Time tagging line

<GPS week> GPS week number

<GPS time> GPS time in week, in seconds (Reference time is Jan 6 1980 at 0hr00)

Header line #1

<label11> local date & time of initialization (dd/mm/yyyy hh:mm:ss)

<value12> Number of initialization cause

<label13> Label of initialization cause

Datum

<stx ><eoln>
!**G**, <GPS week>,<GPS time><eoln>
∗1, <datum No. "datum name"><eoln >
∗2, <"A" value>,<"1/F" value>,< "S" value>,
<unit code><eoln>
∗3, <"Dx" value>,<"Dy" value>,<"Dz" value> ,
<unit code><eoln>
∗4, <"Ax" value>,<"Ay" value>,< "Az" value> ,
<unit code><eoln>

1st line :

Identification of the datum used. The reference is the WGS84. If it is unknown, the datum number is 0, and lines *2 to *4 are not provided.

Projection parameters

"*n*" lines are required to describe the projection parameters whose identifier is <***#n***>. Projection parameters are always preceded by the characteristics of the datum used.

The first line contains the number of the projection type. This number indicates the algorithm used. Is may be followed by a label containing the instance name for the projection type. The labels listed below are just examples.

If the projection is unknown, line #1 reads #1,0,0 and the next lines (2 and 3) are not provided.

<value1> in line **#1** qualifies the coordinate system used:

0: not used

1: standard coordinate system (known datum & projection)

2: not used

3: standard coordinate system with local grid

4: coordinate system with unknown datum & projection

5: coordinate system with known datum & unknown projection

6: coordinate system with unknown datum & known projection

7: coordinate system with local grid and unknown datum & projection

8: coordinate system with local grid, with known datum & unknown projection

9: coordinate system with local grid, with unknown datum & known projection

Tangent conical projection (Lambert)

#1,<**02** "Lambert 1">,<value1><eoln>
#2,<"Lori" valeur>**,**<"Gori"value>**,**
<"Eori" value>**,**<"Nori" value>**,**<unit code><eoln>
#3,<"Ko" value><eoln>

1st line:	Number of projection type used, possibly followed by the name of the projection
2nd line:	*Lori, Gori:* latitude and longitude of origin (angles)
	Eori, Nori: projected (XY) coordinates of origin (distances)
	angle unit code and distance unit code (no separator in between)
3rd line:	*Ko:* Scale factor (a coefficient)

G

Secant conical projection (Lambert)

#**1,**<**03** "Maryland">,<value1><eoln>
#**2,**<"Lref" value>,<"Gori" value>,
<"Eori" value>,<"Nori" value>,
<unit code><eoln>
#**4,**<"LatN value>,<"LatS" value>,<unit code><eoln>

1st line:	Number of projection type used, possibly followed by the name of the projection
2nd line:	*Lref, Gori:* latitude and longitude of origin (angles)
	Eori, Nori: projected (XY) coordinates of origin (distances)
	angle unit code and distance unit code (no separator in between)
3rd line:	*LatN, LatS:* latitudes of 1st and 2nd parallels (scale: 1) (angles)
	angle unit code

UTM projection (Universal Transverse Mercator)

#**1,**<**01** "UTM xx">,<valeur1><eoln>
#**2,**<"Lori" value>,<"Gori" value>,
<"Eori" value>,<"Nori" value>,
<unit code><eoln>
#**3,**<"Ko" value><eoln>

1st line:	Number of projection type used, possibly followed by the name of the projection
2nd line:	*Lori, Gori:* latitude and longitude of origin (angles)
	Eori, Nori: projected (XY) coordinates of origin (distances)
	angle unit code and distance unit code (no separator in between)
3rd line:	*Ko:* Scale factor (a coefficient)

Oblique cylindrical projection (Skew Orthomorphic)

#1,<**04** "Switzerland">,<valeur1><eoln>
#2,<"Lori" value> **,** <"Gori" value>**,**<"Eori" value>**,**
<"Nori" value>**,**<unit code><eoln>
#3,<"Ko" value>**,**<"Skew" value>**,**<unit code><eoln>

1st line:	Number of projection type used, possibly followed by the name of the projection
2nd line:	*Lori, Gori:* latitude and longitude of origin (angles)
	Eori, Nori: projected (XY) coordinates of origin (distances)
	angle unit code and distance unit code (no separator in between)
3rd line:	*Ko:* Scale factor (a coefficient)
	Skew: rotation (an angle)
	angle unit code

Oblique cylindrical projection (Rectified Skew Orthomorphic)

#1,<**05** "Borneo">,<valeur1><eoln>
#2,<"Lori" value>**,**<"Gori" value>**,**
<"Eori" value>**,**<"Nori" value>**,**
<unit code><eoln>
#3,<"Ko" value>**,**<"Skew" value>**,**<unit code><eoln>

1st line:	Number of projection type used, possibly followed by the name of the projection
2nd line:	*Lori, Gori:* latitude and longitude of origin (angles)
	Eori, Nori: projected (XY) coordinates of origin (distances)
	angle unit code and distance unit code (no separator in between)
3rd line:	*Ko:* Scale factor (a coefficient)
	Skew: rotation (an angle)
	angle unit code

Oblique stereographic projection (Skew Stereographic)

#1,<**06** "Holland">,<value1><eoln>
#2,<"Lori" value> **,** <"Gori" value>**,**<"Eori" value>**,**
<"Nori" value>**,**<unit code><eoln>
#3,<"Ko" value><eoln>

1st line:	Number of projection type used, possibly followed by the name of the projection
2nd line:	*Lori, Gori:* latitude and longitude of origin (angles)
	Eori, Nori: projected (XY) coordinates of origin (distances)
	angle unit code and distance unit code (no separator in between)
3rd line:	*Ko:* Scale factor (a coefficient)

Altimetric parameters

"*n*" successive lines are required to describe the altimetric parameters whose identifier is <**%*n***>.

%1,<value1>,<value2>,<value3>,<altitude file name><eoln>
%2,<value1>,<value2>,<value3>,<value4>,<value5><eoln>

%1 : <value1>, <value2> and <value3> stand for the data held by the command $PDAS,ALTI interpretable by GNSS receivers.

<value1> : altitude processing mode

0: with MSL (alti = alti $_{WGS84}$ – MSL – corrections – offset alt)

1: without MSL (alt = alt $_{WGS84}$ – corrections – offset alt)

2: without MSL (alti = alti $_{ellipsoid}$ – corrections – offset alt)

3: with local model

<value2> : Offset altitude with respect to reference surface

<value3> :User correction (0: none, 1linear local altimetry)

<altitude file name>: file name (8 characters - a DOS-compliant name)

%2 : <value1> to <value5> correspond to the data used for the altitude processing.

<value1>: dH

<value2>: GI

<value3>: L0

<value4>: Gg

<value5>: G0

<etx>

Unit code

ASCII character identifying the different units used in a data line, in the same order as the data, and without separator (example: 2b). The unit codes are described in the two tables below.

Length units

unit code	unit	value in metres
1	metre	1
2	US foot	0.304799999
3	imperial foot	0.304797265

Angle units

Unit code	unit	comments
a	degrees, minutes, seconds and fractions of a second	45.120952 for 45° 12' 9.52"
b	degrees and fractions of a degree	45.2026444 for 45° 12' 9.52"
c	grades	
d	radians	
e	seconds	for datum rotation
f	degrees, minutes and fractions of a minute	45.1215866 for 45° 12' 9.52"

RES file example (extracts)

Target point (staking out):

```
!I,991,224383.0
*1,20,11,"CERCLE PT 0","cercle
RAN","centre",,,"implant pt0 centre cercle
ran","05/01/99 15:19:26",
*2,310407.4519,259129.7228,32.3404,1,1
*3,4334402.2854,-112904.9441,4662120.8045,1
*4,,,,,,2.0000,1,1
*9,0.0070,,0.0082,,,0.0099,,1,71,1
*A,55,4334382.4500,-112977.7600,4662151.0700
*T,310407.4450,259129.7060,32.3730,3,1
```

Reference point (staking out):

```
!I,985,487980.7
*1,10,1,"CERCLE PT 0","cercle RAN",,,,"implant
pt ref pt0","27/11/98 16:32:42",
*2,310407.4456,259129.7214,32.3356,1,1
*3,4334402.2832,-112904.9502,4662120.7997,1
*4,,,,,,2.0000,1,1
*9,0.0080,,0.0084,,,0.0100,,1,71,1
*A,55,4334382.4500,-112977.7700,4662151.0600
*T,310407.4450,259129.7060,32.3730,3,1
```

Logged point:

```
!I,991,213439.1
*1,30,1,"1","ant l1l2",,,,"lever ant l1l2 au
labo","05/01/99 12:17:04",
*2,310500.5578,259127.6943,48.7457,1,1
*3,4334412.6379,-112812.0788,4662133.0867,1
*4,,,,,,0.0000,1,1
*9,0.0085,,0.0101,,,0.0118,,1,71,1
*A,55,4334382.4500,-112977.7600,4662151.0700
```

Staking out through linear offset (P then P1, then P2):

```
!I,991,316146.2
*1,22,68,"CERCLE PT 5","cercle pt5","imp dep lin
",,,,"06/01/99 15:48:48"
*2,310385.8092,259117.2186,32.0725,1,1
*4,1.6240,3.0007,0.0000,0.0000,0.0000,2.0000,1,1
*T,310385.8160,259117.2070,32.0710,3,1
```

```
!I,991,316154.5
*1,60,69,"CERCLE PT 5",,,,,"imp lin dep pt5
p1","06/01/99 15:48:55"
*2,310387.2117,259118.0374,32.0842,1,1
*3,4334410.8951,-112924.8239,4662112.0268,1
*4,,,,,,2.0000,,1
*9,0.0078,0.0000,0.0084,0.0000,0.0000,0.0084,0.0
000,1,71,1
*A,55,4334382.4500,-112977.7600,4662151.0700,1

!I,991,316161.7
*1,61,70,"CERCLE PT 5",,,,,"imp lin dep pt5
p2","06/01/99 15:49:03"
*2,310388.4006,259118.7315,32.0941,1,1
*3,4334410.3802,-112923.6562,4662112.5439,1
*4,,,,,,2.0000,,1
*9,0.0082,0.0000,0.0088,0.0000,0.0000,0.0088,0.0
000,1,71,1
*A,55,4334382.4500,-112977.7600,4662151.0700,1
```

Trajectory in distance mode (1 m):

```
!I,991,225589.6
*1,50,16,"11","traj d 1m",,,,"traj dist 1m
depuis pt3","05/01/99 15:39:33",
*2,310385.8069,259142.1892,32.5995,1,1
*3,4334393.5125,-112926.9516,4662128.7296,1
*4,,,,,,2.0000,1,1
*9,0.0133,,0.0176,,,0.0270,,1,61,1
*A,55,4334382.4500,-112977.7600,4662151.0700

!I,991,225601.4
*1,50,17,"12","traj d 1m",,,,"traj dist 1m
depuis pt3","05/01/99 15:39:33",
*2,310386.7175,259141.6349,32.6818,1,1
*3,4334393.9668,-112926.0265,4662128.4444,1
*4,,,,,,2.0000,1,1
*9,0.0126,,0.0166,,,0.0253,,1,61,1
*A,55,4334382.4500,-112977.7600,4662151.0700
```

♣

H. Troubleshooting &Software Installation

GNSS Receiver Status Display

Introduction

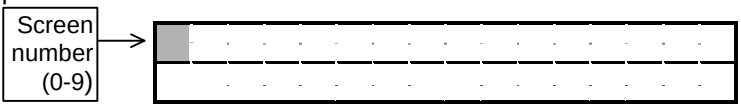
The GNSS receiver used at the base station or as the rover unit is fitted with a 2-line × 16-character display which allows you to check its current operating status. A **Scroll** push-button on the front panel allows you to access the different data available from this display.

When you turn on the receiver, the following message appears on the status display until the self-tests are complete:

```
DASSAULT SERCEL
*GNSS RECEIVER *
```

Then the status display changes as the receiver status changes. Ten different screens have been designed to describe the receiver's internal data (status, configuration, software versions). You only need to use the **Scroll** push-button located on the front panel to access each of these screens. A long press on this button will unconditionally take you back to screen No. 0 (the most important one at receiver start up).

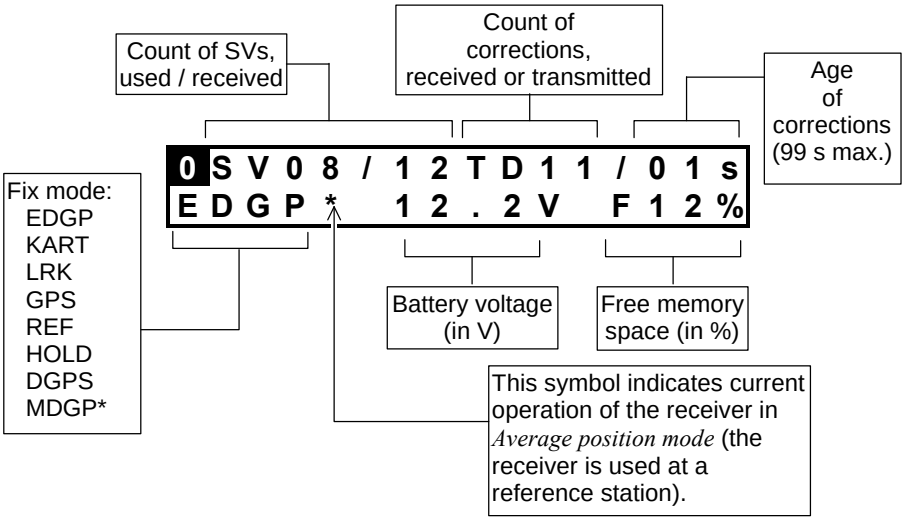
Each screen is identified by a number to help you navigate through the set of screens. The screen number is located at the beginning of the upper line:



When the amount of data is too large to fit on a single screen, several "subscreens" are created for this screen. In this case, the screen number is recalled at the beginning of each subscreen. Use the same button (the **Scroll** push-button) to access the different subscreens (and then to access the next screen).

Screen No.0: Operating Status

At the end of the self-tests, status screen No. **0** appears. Display example:



- **Fix mode**

EDGP (EDGPS)	:	Enhanced DGPS
KART	:	Kinematic Application Real Time
LRK	:	Long-Range Kinematic
GPS	:	"pure" or "straight" GPS
REF	:	User-set reference position (for a station only) (not a computed position)
HOLD	:	No position solution available
DGPS	:	Differential GPS
MDGP (MDGPS)	:	Multi-differential GPS (*: future use)

H

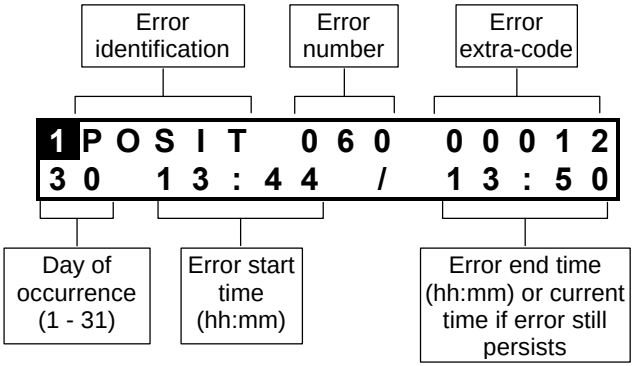
Screen No. **0** (refresh rate: 1.0 second) will be maintained on the status display until you depress the Scroll button.

If an error is detected in the receiver (anomaly, etc.), the screen number will start blinking, prompting you to have a look at screen No.1 to know more about the detected error(s). Unless the detected error still persists, it is simply acknowledged when quitting the screen reporting that error.

With screen No. 0 currently displayed, depressing the **Scroll** push-button repeatedly will cause new screens to appear in the order given below.

Screen No. 1: Error report

Depending on the number of errors detected (none, one or more), several subscreens for screen No. 1 may exist. Display example:

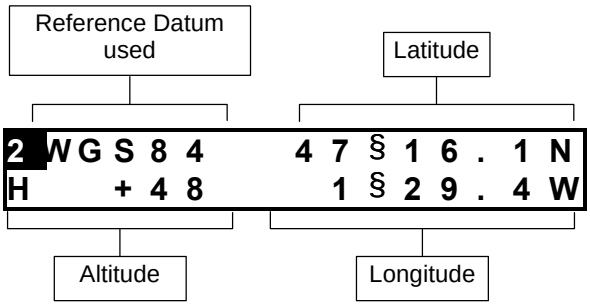


The list of all the possible errors is given in page *H-12*.

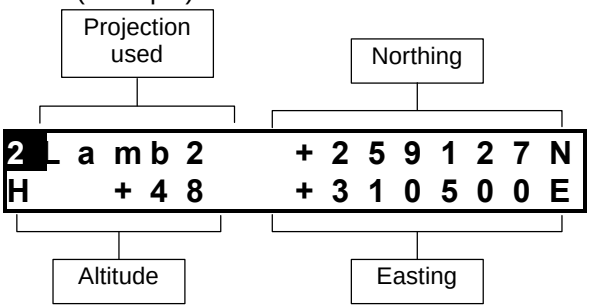
Screen No. 2: Position solution

Depending on the coordinate system used (with or without projection), this screen can be of two different types:

Without projection (example):



With projection (example):



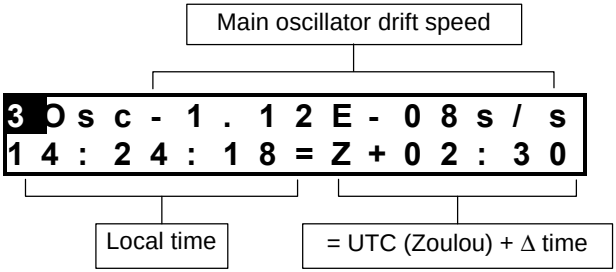
If no solution is available ("HOLD" displayed on screen No.0), this screen will display the "initial position", as defined by the configuration, or the latest position computed in case of lasting solution unavailability, due to reception loss for example.

The position displayed is not for navigation purposes. As it is only a coarse indication of the current position, it does not reflect the real degree of accuracy achieved by the position solution.

H

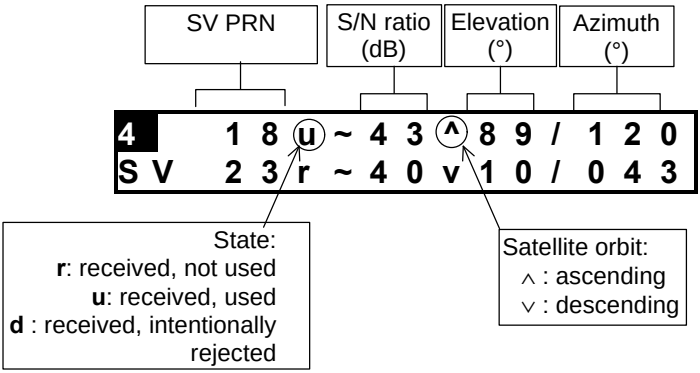
Screen No. 3: Time information

Display example:



Screen No. 4: GNSS reception status

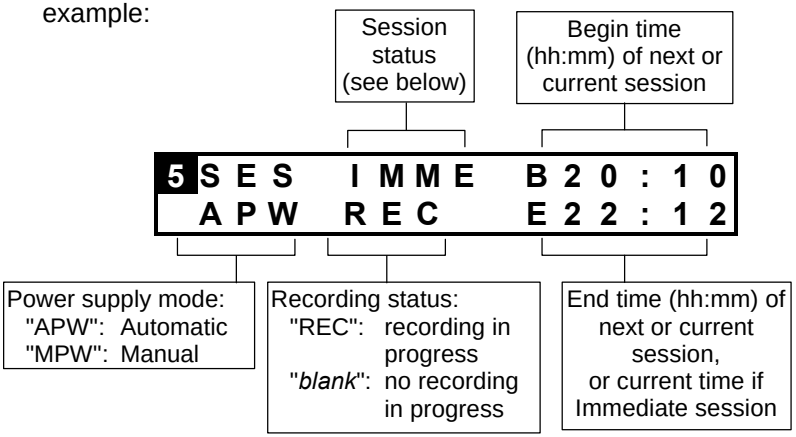
Each line describes the reception of a satellite. Hence, two satellites are shown on a subscreen and *n* subscreens will exist if *2n (*or *2n-1)* satellites are received. Display example:



Screen No. 5: Information about sessions

- **At the base station:**

The current or pending session is described on the screen. Display example:



Power supply mode:

APW : If this option is active, sessions control the power supply of the receiver. The ON/OFF push-button is still usable but it won't turn off the receiver if a session is in progress.

MPW : If this option is active, sessions have no control on the power supply of the receiver. Only the ON/OFF push-button has.

Session status:

ON : Programmed sessions are run once

CYCL : Programmed sessions will be repeated, if this may happen

IMME : Immediate recording session in progress. Data recorded on PCMCIA (if option installed)

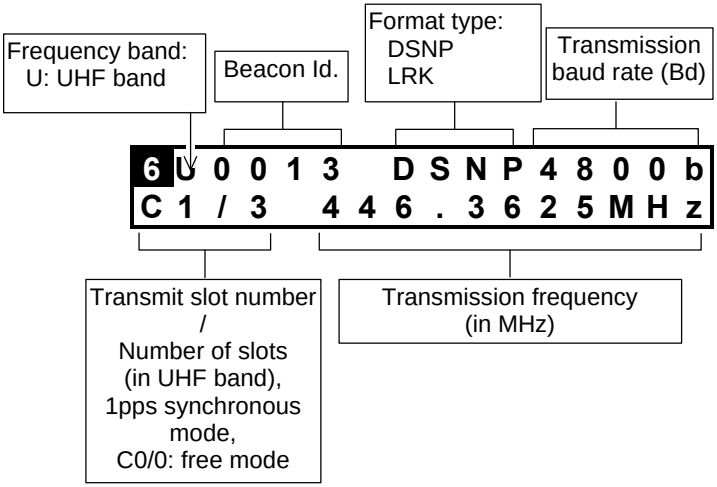
END : All sessions are disabled, or ends the immediate session.

H

Screen No. 6: Information about corrections

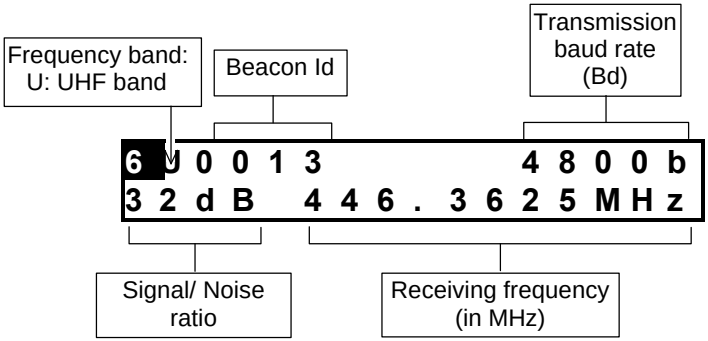
- **At the base station:**

Display example:



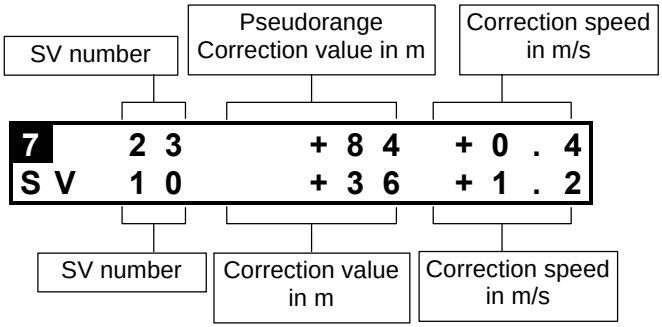
- **On the rover unit:**

  Display example:



Screen No. 7: Differential corrections

Each line describes the correction to be applied to a measurement made from the satellite specified in the line. Hence, two corrections are shown on a subscreen and *n* subscreens will exist if *2n (*or *2n-1)* corrections are computed/received. Display example:

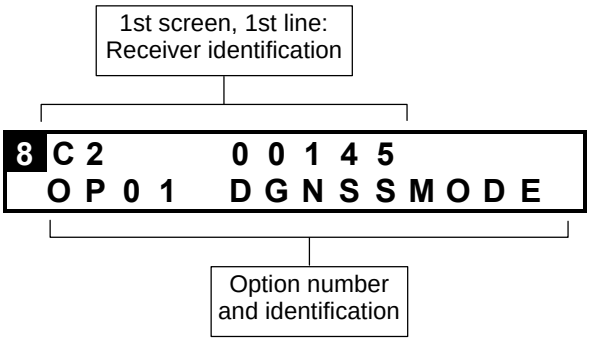


H

Screen No. 8: Firmware installed

The first line indicates the serial number of the receiver. Each of the next lines identifies a firmware option installed in the receiver. The number of subscreens for screen No. 8 will depend on the number of options installed.

Display example:



OP02 : REFSTATION (600x Sx, an option for 600x Mx)

OP03 : KARTMODE (6002)

OP04 : LRKMODE (6002, an option for 6001)

OP05 : USERGEOID (not available yet)

OP06 : RECORDING

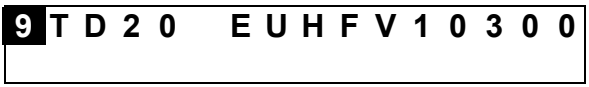
OP07 : QA/QC (not available yet)

OP08 : EDGPS

Screen No. 9: Hardware and Software identification

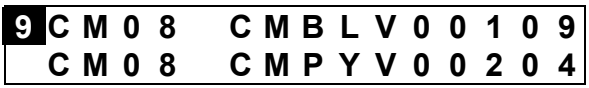
Each subassembly in the receiver is described on a subscreen. Display examples:

Data Link:

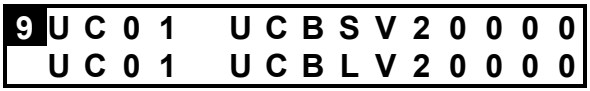


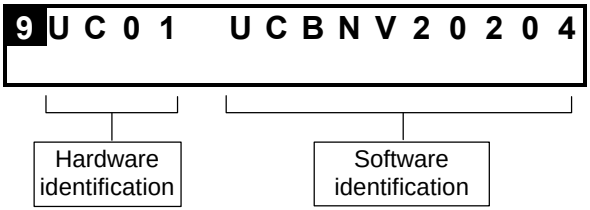
or

GNSS Engine:



UC (CPU) board:





GNSS Receiver Front Panel Indicators

ON/OFF indicator	**Scroll** indicator	**Meaning**
OFF	OFF	Receiver not powered. If this status is obtained after pressing the ON/OFF push-button, check power supply connection (cable, connectors), power source, power voltage, rear panel fuse. If connections are okay and this status is obtained after a period of operation (status possible only at a base station), this means that the receiver has completed the programmed sessions and the receiver is now OFF due to automatic power supply control.
Flashing	OFF	Self-tests in progress (initialization phase)
ON	OFF	Operating receiver. No pending session at the base station.
ON	Flashing	At base station only: operating receiver, due to manual power supply control. Pending session.
OFF	Flashing	At base station only: receiver in standby, due to automatic power supply control. Pending session.
ON	ON	Recording on PCMCIA in progress.

GNSS Receiver Error report

Errors are reported on the status display, on Screen No.1. Each error occupies a "subscreen" (see *Screen No. 1: Error report* chapter, page *H-3*).

Error families

Errors are classified into families, depending on the probable origin of error. The table below summarizes the 11 different error families

Family number	Origin	Error label
00	No errors	NONE
01	Core Module	CM
02	Application Configuration	CONFG
03	DGPS	DGPS
04	Coordinate system	GEODY
05	Input/Output	I/O
06	User Interface	IHM
07	Power supply/interface	INTRF
08	Navigation	NAVIG
09	Fix processing	POSIT
10	System	SYSTM
11	Data link	TD

Error classification

Errors are classified into four categories depending on gravity:

- Simple information reported to user (code 1)
- Warnings (code 2). The receiver operates correctly but might be disturbed by the reported error.
- Serious errors (code 3). The receiver operates but delivers erroneous results.
- Fatal errors (code 4). The receiver can no longer operate correctly. You should re-initialize the receiver.

H

Error list

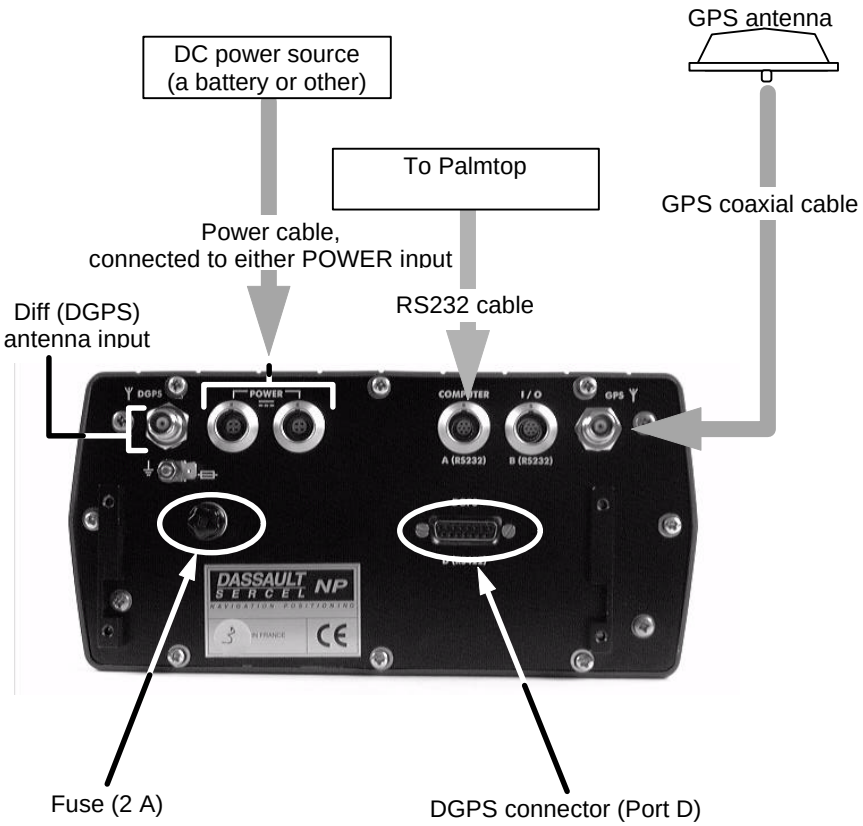
No.	Family	Gra-vity	Meaning	Error label
01	1 - CM	4	GPS not ready	GPS not ready
02	1 - CM	4	RAM error	RAM anomaly
03	1 - CM	3	Processor error	Processor anomaly
04	1 - CM	3	Timing error	Timing anomaly
05	1 - CM	3	Program memory error	Program memory anomaly
06	1 - CM	3	Data memory error	Data memory anomaly
07	1 - CM	3	Reception circuit error	Reception circuit anomaly
08	1 - CM	3	Correlation circuit error	Correlation circuit anom
09	1 - CM	4	C/A-P/YCommunication error	Communication C/A - P/Y
10	1 - CM	2	Non-used output data	Unread output datas
11	1 - CM	2	Non-identified input data	Unknown input datas
12	1 - CM	2	Non-complying input data	Bad input datas
13	1 - CM	1	GPS data error	GPS data anomaly
14	1 - CM	1	DPRAM error	DPRAM anomaly
15	1 - CM	1	Erroneous message length	Bad message length
16	1 - CM	1	EEPROM error	EEPROM anomaly
17	1 - CM	3	Trigger time-tag errorError	Datation Trigger Error
18	2 - CONFG	4	Conf integrity altered	Bad config integrity
19	2 - CONFG	3	Config parameter error	Config parameter error
20	3 - DGPS	3	No transmitting station	No sending dtation
21	3 - DGPS	3	CPU-DIFF overflow	CPU-DIFF overflow
22	4 - GEODY	3	Coordinate system error	Geodesy error
23	5 - I/O	2	Unknown remote command	Unknown telecommand
24	5 - I/O	2	Non-complying param. format	Bad parameter format
25	5 - I/O	2	Non-complying format block	Bad block format
26	5 - I/O	3	Command checksum error	Bad telecommand checksum
27	5 - I/O	3	DPR1 Input error	Input error on DPR1
30	5 - I/O	3	Non-complying LRK block	Bad LRK block on port D
31	5 - I/O	3	Port A Overflow	Overflow PortA
32	5 - I/O	3	Port B Overflow	Overflow PortB
33	5 - I/O	3	Port C Overflow	Overflow PortC
34	5 - I/O	3	Port D Overflow	Overflow PortD
35	5 - I/O	2	Format interpretation error	Format interpretation
36	5 - I/O	3	Port A Input error	Input error PortA
37	5 - I/O	3	Port B Input error	Input error PortB
38	5 - I/O	3	Port C Input error	Input error PortC
39	5 - I/O	3	Port D Input error	Input error PortD
40	6 - IHM	2	User Interface error	IHM error
41	7 - INTRF	4	Xilinx Load	Xilinx Load

42	7 - INTRF	4	Low Power Command	Low Power Command
43	7 - INTRF	3	PCMCIA overflow	PCMCIA overflow
44	7 - INTRF	3	File system full	File system full
45	7 - INTRF	2	PC board not recognized	Unknown PC card
46	7 - INTRF	4	Battery voltage too low	Battery voltage
47	7 - INTRF	3	Corrupted file system	Corrupted file system
48	7 - INTRF	4	First antenna error	First antenna error
52	7 - INTRF	3	File-opening error	File open error
53	7 - INTRF	3	File-closing error	File close error
54	7 - INTRF	3	File-writing error	File write error
55	7 - INTRF	3	File-reading error	File read error
56	8 - NAVIG	3	Navigation error	Navigation error
57	9 - POSIT	1	No differential reception	No differential reception
58	9 - POSIT	1	Too few Svs	Too few Svs
59	9 - POSIT	1	GDOP too high	GDOP too high
60	9 - POSIT	3	LPME too high	LPME too high
61	9 - POSIT	1	No fix computation	No fix computation
62	10 - SYSTM	2	Frozen display	Frozen display
63	10 - SYSTM	2	Unknown option code	Unknown option code
64	10 - SYSTM	4	C3 codes checksum error	Bad checksum codes C3
65	10 - SYSTM	2	Log checksum error	Bad log checksum
66	10 - SYSTM	4	Real-time clock	Real Time Clock
67	10 - SYSTM	4	Dual-port RAM	Dual port RAM
68	11 - SYSTM	4	Core module not ready	Core module not ready
69	10 - SYSTM	4	Program checksum error	Bad program checksum
70	10 - SYSTM	4	Data memory test	Data memory test
71	10 - SYSTM	4	Coprocessor test	Coprocessor test
72	10 - SYSTM	4	Serial port error	Error on serial port
73	10 - SYSTM	3	IDE file system mounting error	File system IDE mount err
74	10 - SYSTM	1	Option lending period has now elapsed	Option no more available
75	10 - SYSTM	4	Nb d'essai options depasse	Max option tries reached
76	10 - SYSTM	1	Journal full	Full anomalies journal
77	10 - SYSTM	3	CMOS date failed	CMOS date Failed
78	11 - TD	4	Selftest error	Autotest error
79	11 - TD	3	Erroneous blocks	Bad blocks
80	11 - TD	1	Count of restarts since selftest	Nb restart since autotest
81	10 - SYSTM	3	Mailbox overflow	Mailbox overflow
82	10 - SYSTM	3	PCMCIA removed	PCMCIA removed
83	5 - I/O	3	DPR1 Overflow	Overflow DPR1
87	10 - SYSTM	3	Line in CM file too long	Line file CM too long
88	10 - SYSTM	3	CM identification error	Identification CM error
89	10 - SYSTM	3	CM card file inconsistency	Incoherence file

H

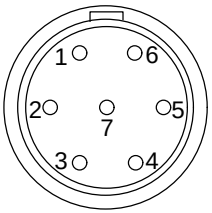
				card CM
90	10 - SYSTM	3	Flash CM clear error	Clear flash CM error
91	10 - SYSTM	3	CM program loading error	CM program file load error
92	6 - IHM	3	Kinematic mode change	Kinematic mode change
93	6 - IHM	3	No position computed	No computed position
94	7 - INTRF	4	Binary file inconsistency	Binary file incoherent
95	10 - SYSTM		RTC send error	RTC send error
96	4 - GEODY		Altimetry error	Altimetry error
97	10 - SYSTM		Applic software Re-load error	Appli soft reload error
98	10 - SYSTM	4	Protected memory error	Back memory failure
99	10 - SYSTM	4	Stack overflow	Stack overflow
100	5 - I/O	2	Error on port A in reception	Receiving error on port A
101	5 - I/O	2	Error on port B in reception	Receiving error on port B
102	5 - I/O	2	Error on port C in reception	Receiving error on port C
103	5 - I/O	2	Error on port D in reception	Receiving error on port D
104	10 - SYSTM	1	Unexpected software error	Software error

GNSS Receiver Rear panel Connectors



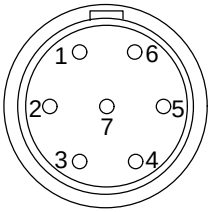
H

COMPUTER connector,
(RS232 Port A),
type: JKX FD1G 07 MSSDSM
(plug: JBX1 MPN), manufacturer: FCI,
pin view



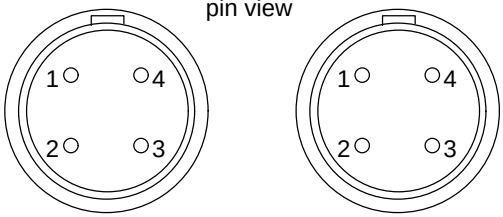
Pin	Signal	
1	+12 V	output
2	TXD	output
3	RXD	input
4	REMOTE ON	input
5	GND	
6	CTS	output
7	RTS	input

I/O connector,
(RS232 Port B),
type: JKX FD1G 07 MSSDSM
(plug: JBX1 MPN), manufacturer: FCI,
pin view



Pin	Signal	
1	+12 V	output
2	TXD	output
3	RXD	input
4	Not used	
5	GND	
6	CTS	output
7	RTS	input

POWER connector
type: JKX FD1G 04 MSSDSM
(plug: JBX1 MPN), manufacturer: FCI,
pin view

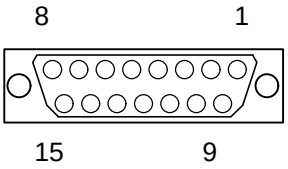


Pin	Signal
1	+ Power input
2	+ Power input
3	- Power input
4	- Power input

TNC-male
coaxial connector
(GNSS antenna input)

TNC-male
coaxial connector
(to/from optional DGPS
antenna)

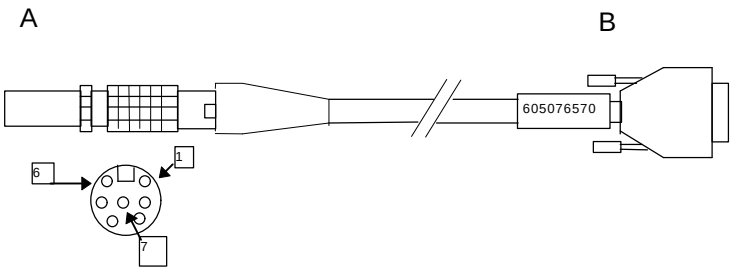
DGPS
connector
(RS422 Port D), pin view,
15-C SubD-female type.
For exclusive use by DSNP UHF
transmitter



Pin	Signal	
1	TXD+	output
2	TXD-	output
3	RXD+	input
4	RXD-	input
5	Not used	
6	GND	
7	GND	
8	+12 V	output
9	Transmitter presence	
10	Transmitter presence	
11	Reserved	
12	Reserved	
13	Reserved	
14	Reserved	
15	Not used	

H

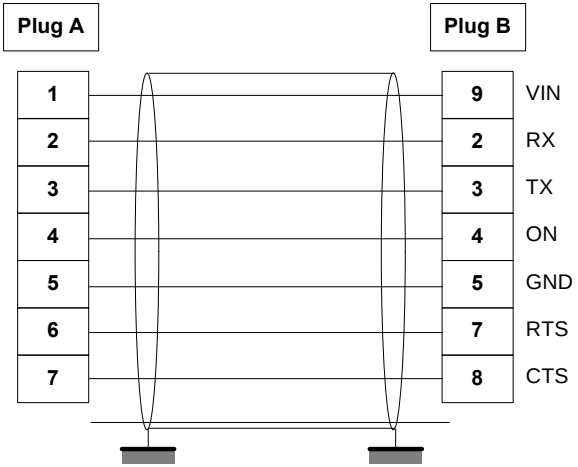
RS232 cable



A is a 7-contact JKX FD 1G 07 MSSDSM (5011253) plug with JBX1 MPN (5080359) sleeve. Manufacturer: FCI.

B is a 9-contact female subD DE-9S (5030357) connector with metal cover 8655MH09-11 (5080357). Manufacturer: FCI.

Shielded cable, 4-pair, FMA2R (6030097). Overall length 2 m.



FSGS Palmtop Computer

FSGS Palmtop Configuration

- **DOS partitioning**

  In the version delivered by the manufacturer, the FSGS palmtop computer comes with 640 kbytes of memory space reserved for the DOS.

  If for any reason, the disk of a palmtop needs to be re-formatted, refer to page *H-24*, *Reformatting the disk.*

- **Battery charging**

  The FSGS has been configured in order that battery charging can take place from a power source present on its RS232C connector.

  After connecting a non-powered FSGS to an operating (powered) receiver, the "`Charging in progress`" message should appear on the FSGS display. If not so, please refer to page *H-27*, *No "charging in progress" message.*

  At equipment delivery, the FSGS is fitted with a NiCd battery pack so there is no particular precaution to be taken. If later, for any reason, alkaline cells have been placed inside the palmtop, the first thing you will have to do *before using the palmtop attached to the receiver* will be to *replace these cells with the NiCd pack.*

Warning!

To avoid pressurization problems inside the FSGS when it is taken on an airline trip, the battery cap has been loosened before shipment. Do not forget to lock this cap as this is required to maintain proper sealing.

H

Software loading

At equipment delivery, the FSGS palmtop is ready for use, which means that the Palmtop software is present in the palmtop.

However, in case of software upgrades or disk re-formatting, you will have to re-load the software on your own, using the procedure described below.

NOTE: On the palmtop, remember you always use this program whether you are programming a base station or surveying with the rover unit. After detecting the type of the attached receiver, the program will configure itself to offer the right interface.

- **Running HCOM Communications utility**
  - Connect the palmtop to a PC-type computer using the 9-pin f/f cable provided (marked with a red sleeve)
  - On the palmtop, run HCOM by typing in "H" (or HCOM<space>/C2 if H.BAT is absent) and then by pressing ↵. The following should appear on the palmtop screen:

- **Upgrading the Palmtop software**

  - On the PC computer, insert the diskette supplied into the drive and choose A: as the current directory (or on C:, choose as current directory the directory containing the files earlier loaded from this diskette).

    The following files should be present in the TOPO directory:

    CMDHCOM.EXE
    TOPOFR.BAT
    TOPOUK.BAT
    TOPOSP.BAT
    TOV20100.CFG
    TOV20100.EXE
    H.BAT
    T.BAT
    TOV201FR.LAN
    TOV201UK.LAN
    TOV201SP.LAN

  - On the PC-type computer, run the batch file TOPOFR.BAT (for French language) or TOPOUK.BAT (for English language) or TOPOSP.BAT (for Spanish language). The following messages should appear successively on the palmtop:

    ```
    receiving TOPO.EXE
    receiving TOPO.LAN
    receiving TOV20100.CFG
    receiving H.BAT
    receiving T.BAT
    ```

    (Similar messages appear on the PC, in French, English, or Spanish depending on the batch file used).

  - On the palmtop, press the ESC key once the "`Reception Complete`" message appears on the palmtop screen, denoting successful upgrading of the resident programs.

H

- **Re-loading software after formatting the palmtop disk**

  In this case the procedure differs from the preceding one in the way the palmtop communications utility is run. Because H.BAT is absent, proceed as follows:

  - on the palmtop, at the DOS prompt, type in "hcom<space>/c2" and then press ↵
  - run TOPOFR, TOPOUK or TOPOSP, as explained earlier.

Maintenance steps

- **Resetting the palmtop**

  If for any reason the palmtop gets stuck (because of illegal operations on the keyboard for example –although this should not have such a consequence), the processor should be reset using a particular key combination, an operation similar to the well known "Ctrl+Alt+Del" on PCs. To reset the processor:

  - press simultaneously the ON red key and the two ⇑ keys (on either side of the "Yes" key) until the screen turns blank
  - Then release the keys and follow the instructions on the screen (type any key, confirm date and time).

- **Reformatting the disk**

  Although this should be extremely rare, you will have to re-format the disk if one of the following messages is returned by the palmtop:

  `Bad Sector in Drive C:`

  or

  `Verify failed sector: x.x`

  or

  `Data corrupted`

  or

  `Potential Data Corruption Detected`

  If the palmtop is still reactive to DOS commands (such as DIR), please skip the next paragraph "Fatal errors" and read "Util" directly.

  Fatal errors

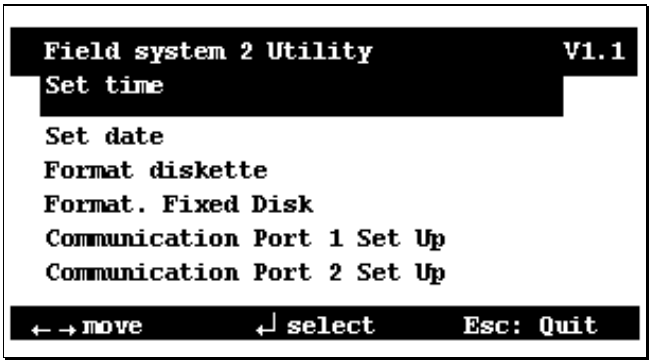
  - If the RAM disk is damaged, the message "`Please contact your system provider`" will be displayed on the screen.
  - In that case, key in the emergency password "`56580`", which will cause the following message to appear: "`Default disk (lose all data) Y/N?`
  - Press "Y" to reformat the RAM disk, which will cause all the files to be deleted, as signaled by the following messages:

    ```
    All data has been erased
    Use UTIL to format fixed disk
    ```

H

Util

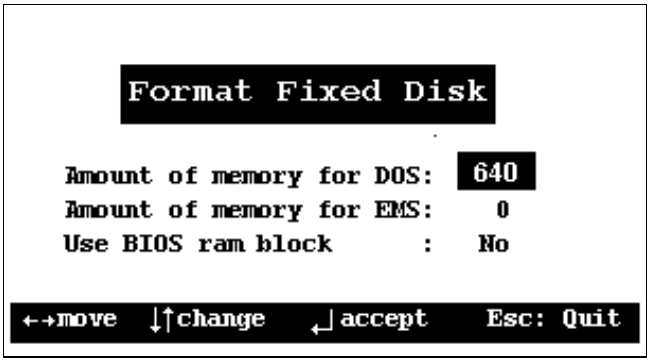
- Type in "UTIL". The main menu appears.



- Using the horizontal-arrow keys, move the cursor to "Format Fixed disk"
- Press the "Yes" key. A new screen appears.

- Using the vertical-arrow keys, have "Yes" displayed in the selected field (instead of "No")

- Press the "Yes" key. A new screen appears.



- The amount of memory for DOS should be 640. If it is different, make it equal to this value using the vertical-arrow keys (increment step: 32kbytes).
- Do not change the other parameters.
- Press the "Yes" key. A new screen appears.

- After loading the DOS, the palmtop asks you to update the date & time
- At the DOS prompt (C>), type in DIR. Check that 7 files are listed.
- To load the Palmtop software, refer to page *H-21*.

- **No "charging in progress" message**

  If this type of message never appears:

  - Press simultaneously the "∗" and "H" keys.
  - Using the direction keys, move the cursor (inverse video) to "Power" and then press ↵. The screen should read:

    ```
    Advanced power management (APM) Yes
    ```

  - Using the direction keys, select "No" and then press ↵. The screen should read:

    ```
    Advanced power management (APM) disabled
    ```

  Another way of disabling the APM is to remove the battery from the palmtop and then to connect a powered Scorpio receiver. The message "charging in progress" will then appear. Then you just have to put the battery back into the palmtop.

- **Reloading the configuration**

  This occurs when the configuration used is incompatible with the palmtop. To load the correct configuration, do the following:

  - Turn off the receiver
  - Turn it on again while holding the **Scroll** push-button depressed until the following message appears:
    `Config reset in progress` (default configuration)
  - Turn on the palmtop. While self-tests are being run, the following message is reported:
    ```
    Mauvaise configuration
    Voulez-vous la recharger ?
    ```
  - Press the "Yes" key. After a few seconds, a bargraph appears indicating that reloading is in progress.

    In the same time, the status display on the receiver front panel reads "`External Config in progress`".
  - At the end of reloading, the palmtop screen automatically comes back to the DOS prompt (C>).

    ♣

Index

2

2D view showing geographical distribution of surveyed points, 4-69

3

3SPack database, 5-13
3SPack Reference Manual, 2-1

A

Accessory container, 1-1
***Accurate point**, 4-23*
***Automatic** power mode, D-18*
Average position mode, 3-7*, 3-11,* D-14

B

Battery compartment, 1-3
Blinking icons, 4-9
Buzzer indications, 4-9

C

Change
Sequence of sessions, D-18
Station parameters, 4-8, D-4
To WGS84, D-28
Checking operating conditions before starting a job, 4-15
Configuration, D-33
Control segment, A-1
Count of SVs used bargraph, D-1
Creating a job without having to resort to KISS, 4-12
Current processing mode, 4-5

D

Data link, 3-7
DGPS antenna input, 1-10
DSNP measurement (antenna height)**, **D-9

E

EGNOS, B-6
Elevation view**, **4-76**, **D-25
Error Report, H-11
Esc key**, **4-7**, **D-4
Estimated time in Average position mode (at base station), D-14

F

F2 key**, **4-7
F4 key**, **4-8**, **D-4
foam trays, 1-1
Frames and subframes, A-3
Free memory space available (reading), 4-85
Front Panel Indicators, H-11

G

GEO files, 4-86, D-16
GLONASS, A-3
GNSS, A-4
GNSS engine, B-2
GPS antenna input, 1-10
GPS antenna location, 3-1
GPS antenna, height measurement
Entering, 3-8

H

HCOM, H-21
Height correction, D-31
Help menus
2D view context, 4-69
Before starting a trajectory survey, 4-44
Distance measurement context, 4-62
During guidance to target, 4-23
During offset procedure (logging), 4-42
During offset procedures (staking out), 4-33
During trajectory survey, 4-45
Just before logging a point, 4-25, 4-35
Notepad context, 4-84
When changing operating mode, 4-80
When creating a line, 4-67
When creating a point, 4-65
When creating a profile, 4-48
When defining or measuring a surface, 4-91
When editing date & time, 4-88
When editing geocodes, 4-88
When recording raw data, 4-71
When refining horizontal system, 4-52
When refining vertical system, 4-56
When rejecting satellites, 4-77
When selecting a file, 4-14
When selecting a job, 4-12
When selecting stake out, 4-17
When viewing GPS constellation, 4-76
When working on the results of a job, 4-60
While following a profile, 4-50

I

Immediate recording at base station, D-17
Initialize Guidance**, **4-23
Intersection offset, 4-37
Invert Axes**, **4-23

J

Jobs and files (distinction), 4-11

K

Kalman filter, C-2
KART fix rate, B-8
KART principle, C-1
KISS module, 2-1

L

***Lateral offset**, **4-27**, 4-36*
Light (front panel screen light), 1-8
Linear offset, 4-26, 4-36
Load
Geodesy, D-29
Position from PCMCIA to base station, D-10
Loading coordinate system to base station, D-11
Local Grid, D-30, G-5
LR Kinematic accuracy, B-7
LR Rapid Static accuracy, B-7
LRK principle, C-4

M

Magnified view around the target, 4-21
Measuring a surface, 4-90
Measuring the distance between 2 points, 4-61

Menus
Function, 4-6, D-2
Help, 4-7, D-3
Main, 4-6, D-2

N

Notepad, 4-62, 4-83, 4-93, D-22

O

***ON/OFF** pushbutton, 1-8, 3-7, 3-8, 4-4*
Orbits, A-1
OTF, B-8

P

Palmtop, 1-13
Configuration, H-20
Connecting, 3-8
Humidity indicator strip, 1-14
NiCd batteries, battery cap, 1-13, 1-15
Re-format disk, H-24
Reset, H-23
Software loading, H-21
Temperature range, 1-14
Trickle-charged internal battery, 1-14
Upgrading station software, H-22
PCMCIA, 1-10, 1-11, 1-12
Load coord system from, 3-9
Saving files from, 5-14
POINT**, **4-78
POWER connectors, 1-10
Power source
Batteries for Rover unit, 1-16
Drain, B-5
Swap, 1-10
Voltage range, B-5
Product applications, B-3
Profile (definition), 4-47
Project
Create, 2-1
Export results, 5-13
Post-process, 5-14
Preparing PCMCIA cards, 2-13
Reference points, 2-8
Target points, 2-10
Project Wizard-Horizontal System**, **2-2
Project Wizard-Welcome**, **2-1

R

Real time point**, **4-23
Receiver holder, 1-5
Recorders (600x xP), B-1
Release, D-33
Remaining Points**, **2-13
Results
RES file example, G-19
Rover unit
Preparing for field survey, 4-1
Rover unit assembly, 1-3
RS232 connectors, 1-10
RS422 connector, 1-10

S

S/N ratio view**, **4-76**, **D-25
***Scroll** pushbutton, 1-8, H-1*
Self-tests, 1-8, H-1
Sessions, D-18
As reported on status display, H-6
Indicator light, 1-8, 1-9
programmed, D-18
Run sequence at base station, D-20
***Shift+F1** key combination, 4-8, 4-83, D-4*
Shoulder straps, 1-4
Space segment, A-1
Standalone mode, 4-94

Standard features, B-6
STATIC**, **4-78
Station characteristics, 3-10, 3-13
Station container, 1-5
Station control software
Antenna function, D-8
Average position function, D-13
Getting started, 4-9, D-6
Position function, D-9
Transmitter function, D-12
Status display, 1-8, 1-9, 3-7, H-1
Straight GPS, 3-10, D-10
Surface, 4-90
SV Deselection, D-26
System Tools, D-32

T

Targets and target points, 2-7
Time, D-32
Trajectory, 4-43
Transmit indicator, D-1

U

UHF antenna location, 3-2
UHF coverage, B-8
UHF receiver, B-5, B-6
UHF transmission mode, 3-7
UHF transmitter, 1-10, B-5, B-7
Unit code, G-18
Units used, 4-94
User measurement (antenna height)**, **D-9
User segment, A-1, A-2

V

Verifying the reference position you enter (base station), D-10
Vertical axis, 4-20
Visible Constellation, D-24

W

Walking to the target, 4-20
WAAS, B-6
WAD, A-4
***Write Project** command, 2-13*

Z

ZFIXED**, **4-78

DSNP

16 rue de Bel Air B.P. 433
44474 CARQUEFOU Cedex

☎ +33 (0)2 40 30 59 00. Fax +33 (0)2 40 30 58 92
Web site: www.dsnp.com

S.A. à Directoire et Conseil de surveillance
au capital de 5 000 000 F

RCS Nantes B 321 391 237